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HI-TECH HORTICULTURAL SOCIETY

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[Founded in November 2008]

The main object of the Society is to cultivate and promote research, education and development in the field of horticulture.

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Proceedings of International Conference
On
“Issues for Climate Change, Land Use Diversification and Biotechnological Tools for Livelihood Security” organized by Hi-Tech Horticultural Society, Meerut during 08-10 October, 2011 at SVPUA&T, Meerut

P 35,457

Inaugural ceremony

Dr. AK Singh, Deputy Director General (NRM), Indian Council of Agriculture Research, New Delhi, Inaugurated the three days international conference on “Issues for climate change, land use diversification and biotechnological tools for livelihood security” by lightening the lamp at Sardar Vallabhbhai Patel University of Agriculture and Technology auditorium. Dr. RS Kureel, Vice Chancellor, Narendra Dev Agriculture and Technology University, Faizabad, Dr. MS Aulakh, Vice chancellor, M.S.K.J.U.A.T, Banda were the Guests of Honor during the function. Dr. AK Bakhsi , Vice Chancellor, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut could not attended the function due to his illness.

In his inaugural speech, Dr AK Singh, emphasized upon the importance of conservation of natural resources and discontinuation of its unnecessary exploitation. This is possible only by a judicious use of fast declining natural resources. All the programmes should focus on mitigating the harmful effects of climate change and it should focus upon the requirements of farmers and common people. New emerging technologies in agriculture are very useful in increasing the productivity and yield in agriculture.

The guests of honour, Dr. RS Kureel, said that agriculture scientists must provide training to the farmers for the useful technologies related to their farming for increasing the productivity and profit. Farmers should be encouraged to cultivate the best suited crop of a particular region based on soil fertility and climate of that area or location and new technology may be developed through modern biotechnological approaches for the benefit of mankind. Dr. MS Aulakh said that in future due to climate change crop production will be a challenge and we should be well prepared in advance to fight this challenge. He emphasized on increasing the production by introducing transgenic crops.

Dr Anil Sirohi, Dean, College of Biotechnology read the message of Dr. AK Bakhsi, Dr. Raguveer Singh Dean, College of Agriculture gave brief information about the University. Organizing Secretary of the International Conference, Dr. Bijendra Singh, highlighted the organizational activities of High-tech Horticulture society and extended welcome to the delegates and dignitaries attanding the conference. A formal vote of thanks was extended by Dr. S K Bhatnagar Director Placement.

More than 700 scientist from India and abroad participated in the conference Scientists from Bhutan, Bangladesh and Nepal also participated in the conference. On this occasion professors and scientist of the university extended valuable contribution in making the conference successful.

About 50 Scientist from the fields of agriculture and basic sciences from different organization were awarded for their contribution in different fields.

Inaugural function by lightening the lamp by Chief guest Dr. A.K. Singh, DDG, NRM, ICAR and Dr. Bijendra Singh, Organizing Secretary, ICLDBT2011

INTERNATIONAL CONFERENCE
ISSUES FOR CLIMATE CHANGE, LAND USE DIVERSIFICATION & BIOTECHNOLOGICAL TOOLS FOR LIVELIHOOD SECURITY (ICLDBT-2011)
Hosted By :-Sardar Vallabhbhai Patel University of Agriculture & Technology Meerut
Hi-Tech Horticultural Society

The Inaugural speech by Chief Guest, Dr. AK Singh

Delegates and Officers of the University Participating in ICLDBT-2011

INTERNATIONAL CONFERENCE
ISSUES FOR CLIMATE CHANGE, LAND USE DIVERSIFICATION & BIOTECHNOLOGICAL TOOLS FOR LIVELIHOOD SECURITY (ICLDBT-2011)
Hosted By :-Sardar Vallabhbhai Patel University of Agriculture & Technology Meerut
Hi-Tech Horticultural Society
Meerut -250 110 (U.P.) India
Kumaun University

Inaugural speech by the guests of honors, Dr. MS Aulakh, V.C. ,M.S.K.J.U.A.T, Banda and Dr. RS Kureel , V.C., NDUA&T, Faizabad

INTERNATIONAL CONFERENCE
on
ISSUES FOR CLIMATE CHANGE, LAND USE DIVERSIFICATION &
BIOTECHNOLOGICAL TOOLS FOR LIVELIHOOD SECURITY (ICLDBT-201
October 08-10, 2011
Hosted By :-Sardar Vallabhbhai Patel University of Agriculture & Technology Meer

Release of Souvenir by the dignitaries on the Dias

ISSUES FOR CLIMATE CHANGE, LAND USE DIVERSIFICATION &
TECHNOLOGICAL TOOLS FOR LIVELIHOOD SECURITY (ICLDBT-2011)
INTERNATIONAL CONFERENCE
Hosted By :-Sardar Vallabhbhai Patel University of Agriculture & Technology Meerut

Welcome speech by Dr. Bijendra Singh, Organizing Secretary, ICLDBT-2011

HI-TECH HORTICULTURE SOCIETY AWARDS

1. **Rajesh Pilot Memorial Award -2011**
   - **Dr. A.K. Singh**, DDG NRM, ICAR, New Delhi
     For his special contribution in the area ofAGRICULTURAL SCIENCES

2. **Life Time Achievement Award -2011**
   - **Dr. M.S. Aulakh**, VC, MSKJUAT, Banda (UP)
     For his special contribution in the area ofAGRICULTURAL SCIENCES
   - **Dr. R.S. Kureel**, VC, NDUAT, Faizabad(UP)
     For his special contribution in the area ofAGRICULTURAL SCIENCES
   - **Dr. Ramesh Kumar**, Director, Directorate of Floricultural Research, ICAR, Pusa Campus, New Delhi-
     For his special contribution in the area of- Floriculture

3. **Hon. Fellowship -2011**
   - **Dr. R.K. Gupta**, Director, CIPHET, Ludhiana
     For his special contribution in the area of AGRIL. & FOOD ENGG.
     For his special contribution in the area ofFloriculture & landscaping
   - **Dr. H. Ravishankar**, Director, CISH, Lucknow (U.P.)-
     For his special contribution in the area of Pomology
   - **Dr. H.B. Singh**, Scientist, DST, New Delhi
     For his special contribution in the area ofMICROBILOGY

4. **Fellowship Award -2011**
   - **Dr. Bijendra Singh**, Ex- Director, IIVR, Varanasi
     For his special contribution in the area ofVEGETABLE SCIENCE
   - **Dr. J.S. Chauhan**, Director, DRMR, Bharatpur(Raj.)-
     For his special contribution in the area of Plant Breeding
   - **Dr. Sangeeta Ladha**, Director, IHITHC, Jaipur (Raj.)
     For her special contribution in the area ofHORTICULTURAL SCIENCES

5. **Distinguish Scientist Award -2011**
   - **Dr. Balraj Singh**, Principal Scientist, IARI, New Delhi
     For his special contribution in the area of-VEGETABLE SCIENCES
   - **Dr. Rouhangiz Hayati Dhaiya**, Prof. ABS, Amity University, Rajasthan-
     For her special contribution in the area ofHorticultural Sciences

6. **Scientist of The Year Award -2011**
   - **Dr. P.L. Saroj**, Principal Scientist, ICAR, KAB-2, New Delhi-
     For his special contribution in the area of-Horticultural Sciences
   - **Dr. Anubhuti Sharma**, Asstt. Prof., Dept. of Bioscience & biotechnology, Banasthali Vidhyapeeth (Raj.)-

   For her special contribution in the area ofPlant Molecular Biology

7. **Young Scientist Award -2011**
   - **Dr. Vijay Bahadur**, Asstt.. Prof., Dept. of Horticulture, SHIATS, Allahabad
     For his special contribution in the area ofVegetable Science
   - **Dr. Manisha Mangal**, Senior Scientist, CIPHET, Ludhiana(Punjab)-
     For her special contribution in the area ofPlant Biotechnology

8. **Young Scientist Associate Award -2011**
   - **Dr. R.K. Dhall**, Asstt. Olericulturist, Dept. of Vegetable Crops, PAU, Ludhiana
     For his special contribution in the area of vegetable sciences.
   - **Dr. Rajiv Kumar**, Senior Scientist, Division of Ornamental Crops, IIHR, Hessaraghatta, Bengaluru (Karnataka)-
     For his special contribution in the area of Floriculture

9. **HTHS Gold Madel -2011**
   - **Dr. Satyavir Singh Chaudhary**, Assoc. Prof. Deptt. of Floriculture & Landscaping, Dr. Y.S. Parmar Uni. Of Hort. & Forestry, Nauni, Solan(H.P.)- For his special contribution in the area ofFloriculture & Landscaping
   - **Dr. S.N.S. Chaurasia**, Principal Scientist & Head, Division of Vegetable Production, IIVR, Jakhini,Varanasi (U.P.)-
     For his special contribution in the area ofVegetable Sciences
   - **Dr. Gunjeet Kumar**, Sr. Scientist, Directorate of Floriculture, IARI, New Delhi For his special contribution in the area ofFloriculture
   - **Dr. R.S. Sengar**, Assoc. Prof. Biotech., SVPUAT, Meerut
     For his special contribution in the area ofBiotechnology /Plant Physiology
   - **Dr. V.P. Singh**, Associate Professor, VCSG College of Horticulture GBPUA&T, Bharsar, Pauri Garwal(UK) For his special contribution in the area of Horticultural Sciences

10. **HTHS Innovative Farmer Award-2011**
    - Sh. Dushyant Raghaw, Vill. & PO- Daulah, Dist.-Gurgaon (Haryana)
    - Sh. Parmender Singh, Mithapur, Meerut
    - Sh. Rajbeer Singh, Bulandsher
    - Sh. Raghuraj Singh, Daurala, Meerut

Day One (08-10-2011)

Technical Sessions were convened by Prof. S.K. Bhatnagar, Prof. C.S. Prasad & Prof. Anil Sirohi. Following sessions were organied.

Technical session-I

Chairman: Dr. R.K. Tyagi, Co-Chairman: Dr Balraj Singh
Rapporteur: Dr. Nidhi Verma, Dr. H.L. Singh

Speakers: Dr. Bijendra Pal, Dr. **R K Tyagi, Dr D B Parakh,** Dr. **V. K. Singh,** Dr. Neelima Garg, Dr. Anubhuti Sharma, Dr. Choney Zangmo, Dr. Apoorv Prakash, Ms. Dorji Wangmo, Mr. H M Mohammed

Technical Session II

Chairman: Dr. R.K. Gupta, Co - Chairman: Dr. B. Singh
Rapporteur: Dr. Pushpendra Kumar, Dr. Sangeeta Bansal
Speakers: Dr. S.S. Mehetre, Dr. P.L Saroj, Dr. S. Rajan, Dr. A.K. Sharma, Dr. P.K. Rai, Mr. T.M. Chomrey, Mr. Karan Singh Dhami

Technical Session III

Chairman: Dr. V.K. Suri, Co Chairman: Dr. Balraj Singh
Rapporteur: Dr. U.P. Shahi, Dr. A.K. Sharma
Speakers : Dr. J.S. Chauhan, Dr Nidhi Verma, Dr. B. Singh, Dr. Ajay Verma, Dr. C.S. Verma, Dr N. Vijay Kumari, Dr. Janardan Jee

Technical Session IV

Chairman: Dr. J.S. Chauhan, Co - Chairman: Dr. T.R. Rupa
Rapporteur: Dr. Randhir Singh, Dr. Luxman Prasad
Speakers: R.K. Choudhary, Dr. Roughie Dhaiya, Dr. Azad Panwar, Dr. Nagendra Rai Dr. N.B. Singh, Dr. Md. Shafiq Alam, Ms. Priyanka Suryavanshi, Mr. Virendra Gautam

Day Two (09-10-2011)

Poster Presentation (Theme Area 1)

Technical Session V

Convenor: Dr Roughie Dhaiya Chairman: Dr. Ramesh Kumar
Co Chairman: Dr. V.K. Singh
Rapporteur: Dr. Nagendra Rai, Dr. Purushottam
Speakers: Dr. C. Dev Kumar, Dr. Ramesh Kumar, Dr. T.R. Rupa, Dr. Y.P. Singh, Dr. R.P.S. Verma, Dr. Daljeet Singh, Dr. S.K. Singh, Dr. R.K. Dhall, Preeti Gautam

INTERNATIONAL CONFERENCE
ISSUES FOR CLIMATE CHANGE, LAND USE DIVERSIFICATION &
BIOTECHNOLOGICAL TOOLS FOR LIVELIHOOD SECURITY (ICLDBT-2011)
October 08-10, 2011
Hosted By :-Sardar Vallabhbhai Patel University of Agriculture & Technology Meerut
Organized by:
Hi-Tech Horticultural Society
Society for Recent Development in Agriculture
Sponsored by:

Lead, Oral & poster presentation by the delegates during the conference

Kavi Sammalen at evening

Kavi sammelen was organized at Narayan farm in the evening for the participant of international conference. Rahul Dev chaired this programme. Poet Suman Sharma delivered or was convenor of the programme, Summesh , Suman Sharma, Ishear Chand Gambhir, Shanty Swarup, Rajkumar Sisodhia participated in this poet night.

Technical Session VI
Chairman: Dr. M.S. Aulak
Co Chairman: Dr. Nidhi Verma
Rapporteur: Dr. Vaishali, Dr. Veena Pandey

Speakers: Dr. V.K. Suri, Dr. T.A. More, Dr. Rajendra Kumar, Dr. Ajay Verma, Dr. Ravindra Kumar, Dr. Salaheddin Bashir, Mr. Bhojraj Belakud, Mr. Vikash Kumar

Poster Presentation (Theme Area 2 & 3)

Technical Session VII
Chairman: Dr. J.S.Rawat
Co Chairman: Dr. Roughie Dhaiya
Rapporteur: Dr. R.P.S. Verma, Dr. Gopal Singh

Speakers : Dr. B.S. Mahapatra, Dr. J.S. Rawat , Dr. S.S. Singh, Dr. Balraj Singh, Dr. Y.S. Shivay, Dr. J.N. Govil, Dr. Anshu Sharma, Dr. A.K. Pandey

Technical Session VIII
Chairman: Prof. S.S. Bargali
Co Chairman: Dr. V.V. Singh
Rapporteur: Dr. Shalini Gupta, Dr. D.V. Singh

Speakers : Dr. Kanhiya Lal, Dr. S.K. Bhatnagar, Dr. Sheo Punjan Singh, Dr. Sumit Mahajan, Dr. M. Hasan, Dr. Nitin Trivedi, Dr. Veena Pandey, Dr. R.K. Agarwal

Technical Session IX, Farmers Scientist Interaction

Convenor : Dr Satya Prakash
Chairman: Dr. R.K. Choudhary
Co Chairman: Dr. Babu Ram
Rapporteur: Dr. Satendra Kumar, Dr. P.K. Singh
Expert Panel - Dr. Gaje Singh, Dr. B.P. Dhyani, Dr. Vivek, Dr. Gopal Singh, Dr. L.K. Gangwar, Dr. R.P.S. Verma, Dr. A.K. Pandey

Closing ceremony

The Chief Guest, Dr. Prabhat Kumar (IAS), said that climate change has both positive as well as negative effect on agriculture. Therefore, to minimize losses due to climate change, researches should be done in this area to ensure food security to the increasing populations. Dr. VPS Arora, Vice Chancellor, Kumaon University, Nainital and Chairman of the session in his speech said that underground water, drinking water and rain water are affected due to environmental conditions. He emphasized the need ensuring of quality of water, land, air and environment for plants and animal security and livelihood.

Closing speech by Chief Guest, Dr. Prabhat Kumar,IAS and Dr. VPS Arora, V.C., Kumaon University, Nainital

INTERNATIONAL
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ISSUES FOR CLIMATE CHANGE, LAND USE
IOTECHNOLOGICAL TOOLS FOR LIVELIHOOD S
October 08-10, 2011
Hosted By :-Sardar Vall bhai Patel University of Agri

Release of The magazine of Narayana Foundation

Dr. Bijendra Singh, Organizing Secretary, ICLDBT-2011 honored The Chief Guest Dr. Prabhat Kumar, IAS.

The session was concluded after the presentation of awards of Society for Recent Development in Agriculture for the year 2010-2011.

1. **Rewati Singh Memorial National Productivity Award-2011**
   - **Dr. Prabhat Kumar**, IAS, Director Business & Country Relation, ICRISAT, New Delhi
     For his special contribution in the area ofADMINSTRATIVE SERVICES

2. **Dr. Lakhiram Memorial Award -2011**
   - **Dr. V.P.S. Arora**, VC, Kumaun University Nainital(UK)
     For his special contribution in the area ofAGRICULTURAL ECONOMICS
   - **Dr. L.S. Rathore**, Ministry of Earth Science, New Delhi
     For his special contribution in the area ofSOIL SCIENC

3. **Life Time Achievement Award -2011**
    - **Dr. T.A. More**, VC, MPKV, Rahuri(Mh.)
      For his special contribution in the area ofVEGETABLE SCIENCES
    - **Dr. R.S. Rathore**, DDG, UPCAR, Lucknow
      For his special contribution in the area ofAGRONOMY
    - **Dr. Vipin Garg**, V.C., Ch. Charan Singh University, Meerut(UP)-
      For his special contribution in the area of-BOTANY
    - **Dr. R.P.S. Verma**, Principal Scientist, DWR,ICAR, Karnal (Haryana)-
      For his special contribution in the area ofPLANT BREEDING

4. **Hon. Fellowship Award -2011**
    - **Dr. B.S. Mahapatra**, Director, CRIJAF, ICAR, Barrackpore(W.B.)
      For his special contribution in the area ofAGRONOMY

    - **Dr. K.C. Bansal**, Director, NBPGR, New Delhi
      For his special contribution in the area ofBIOTECHNOLOGY

    - **Dr. K.K. Singh**, Director, Seed and Farms, Bihar Agricultural University, Sabour, (Bihar) For his special contribution in the area ofSeed Science & Technology

    - **Dr. C. Dev Kumar**, ADG, EPD, ICAR, KAB-2, New Delhi
      For his special contribution in the area of-ORGANIC CHEMISTRY

5. **Fellowship Award -2011**
    - **Dr. K.K. Singh**, Scientist-F, Ministry of Earth Science, New Delhi
      For his special contribution in the area ofSOIL SCIENCE
    - **Dr. A.S. Panwar**, Principal Scientist (Agronomy), Head, Farming System Research, ICAR Research Complex for NEH Region Umiam, Meghalaya-
      For his special contribution in the area ofAGRONOMY
    - **Dr. R.A. Singh.**, Advisor-FPARP, Directorate of Extension, C.S.A.U.A.T, Kanpur (UP)
      For his special contribution in the area ofAgronomy/Rain Water Harvesting

6. **Distinguish Scientist Award -2011**
    - **Dr. Vijay Veer Singh**, Principal Scientist & I/C, Crop Improvement Unit, Directorate of Rape seed-Mustard Research, Sewar, Bharatpur (Raj)
      For his special contribution in the area ofCROP IMPROVEMENT
    - **Dr. R.K. Tyagi**, Head and Principal Scientist, Division of Germplasm Conservation, NBPGR, New Delhi For his special contribution in the area ofManagement of Plant Genetic Resources
    - **Prof. H.B. Singh,** Professor, Deptt. of Plant Pathology, B.H.U, Varanasi (U.P.)
      For his special contribution in the area of Plant Pathology

7. **Scientist of The Year Award -2011**
    - **Dr. Sandeep Kumar Lal**, Sr. Scientist, Division of Seed Science & Technology, IARI, New Delhi For his special contribution in the area ofSeed Science & Technology
    - **Dr. D..B. Parakh**, Principal Scientist, NBPGR, New Delhi
      For his special contribution in the area ofPLANT PATHOLOGY

8. **Kunwar Saxena Bahadur SRDA Award -2011**
   - **Dr. A.K. Jha**, Scientist//Asstt. Prof., Dept. of Agronomy, JNKVV, Jabalpur
     For his special contribution in the area of Agronomy (Conservation Agriculture)
   - **Dr. M.S. Alam**, Processing Engineer, Dept. of Process & Food Engineering, PAU, Ludhiana (Punjab) For his special contribution in the area of Processing & food Engineering

9. **Major R.S. Yadav SRDA Award -2011**
   - **Dr. Manoj Nazir**, Scientist Floriculture, Directorate of Agriculture, Jammu
     For his special contribution in the area of- FLORICULTURE
   - **Dr. Janardan Jee**, Head & Principal Scientist, ICAR-RCER, Patna (Bihar)-
     For his special contribution in the area of Aphidology (Agril. Entomology)
   - **Dr. Anoop Dixit**, Research Engineer, Dept. of Farm Machinery & Power Engineering, PAU, Ludhiana (Punjab) For his special contribution in the area of Farm Machinery & Power Engineering

10. **Young Scientist Award -2011**
    - **Dr. Devi Singh**, Asstt. Prof., Dept. of Horticulture, SHIATS, Allahabad(U.P.)-
      For his special contribution in the area of Vegetable Science
    - **Dr. Dharma Paul Chaudhary**, Sr. Scientist, DMR, IARI, New Delhi
      For his special contribution in the area of Biochemistry

11. **Young Scientist Associate Award -2011**
    - **Sh. Ajay Kumar**, TIFR, Mumbai (Mh.)-
      For his special contribution in the area of Biological Sciences/Biotechnology
    - **Dr. Sunil Kumar**, Asstt. Professor, College of Forestry & Hill Agriculture, GBPUA&T, Hill Campus, Rani Chauri, Tehri Garhwal, (UK)-
      For his special contribution in the area of Animal Science

12. **SRDA Gold Medal -2011**
    - **Dr. K.G. Singh**, Sr. Research Engineer, Dept. of Soil & Water Engineering, PAU, Ludhiana(Punjab) For his special contribution in the area of Soil & Water Engineering
    - **Dr. D.N. Yadav**, Scientist, CIPHET, Ludhiana
      For his special contribution in the area of AGRICULTURAL SCIENCES
    - **Dr. Neetu Singh**. Head, Dept. of Biotechnology, Mewar Institute of Management, Ghaziabad (UP) For her special contribution in the area of Biotechnology
    - **Ms. Nidhi Gupta**,Dept. of Biotechnology, Banasthali Vidhyapeeth, (Raj)
      For her special contribution in the area of Biotechnology

13. **Young Fellow Award -2011**
    - **Dr. Renu Singh**, Scientist, Division of Environmental Sciences, IARI, New Delhi For her special contribution in the area of Environmental Sciences
    - **Dr. Naresh Kumar**, Scientist (Plant Breeding), CARI, Port Blair Andaman and Nicobar Island For his special contribution in the area of Plant Breeding
    - **Dr. Shilpi Sen**, Lecturer, Dept. of Biotechnology, Ch. Charan Singh University, Meerut
      For her special contribution in the area of Industrial Biotechnology

14. **Best Editor Award -2011**
    - **Dr. J.N. Govil**, Director & Managing Editor (Publishing), Studium Press LLC USA ,Indian Branch ,New Delhi For his special contribution in the area ofGenetics & Plant Breeding

15. **SRDA Innovative Farmers Award-2011**
    - **Sh. Subodh Kumar Tyagi,** Bhuni, Meerut
    - **Sh. Naval Singh,** Dhanju, Meerut

Recommendations

1. Agriculture in India, supports 70 percent of the population for livelihood security, however, the true potential of this sector is yet to be harnessed. India has all the ingredients for an agro-industrial revolution man, money and material, but due to the absence of entrepreneurship, there is very little value addition at the farm level and 98 percent of our farm produce is sold in the raw form. It is therefore recommended that a large scale training and entrepreneurship development programmes be launched annually in the farm sector.

2. Agriculture sector improvement needs an holistic approach. There is a need of policy integration at the grass root level. The policies should aim at welfare of the farmers by increase in their income, in addition to the increase in the production and productivity. There is a need to reintegrate crop based agriculture and horticulture practices to best harness the potential of this sector in India. Special attention is required to promote the biotechnology to the development of horticulture and floriculture crops in India, which can add much value to the Indian economy.

3. There is a need to identify technologies , economic policy options and priorities , to buffer climate change impacts through mitigation and adaptation and ecosystem resilience. Also, identifying the effective modalities and mechanism of co- operative parternership between various national , regional and international institute and organization.

4. Mobilising and international co-operation to support research and development activities to cope with climate change.

5. Farmers should be informed about environment related aspect of agriculture along with crops production ie. nature of soil or type of soil , productivity, soil water etc and to do this publication of magazines, having awareness programmes useful for farmers is recommended.

6. Scientist should update farmers community with knowledge on crops developed through biotechnology and remove their doubts and misunderstanding on transgenic crops like insect resistant plant and genetically modified crops. There will be a need of biotechnology contribution in ensure food security so that increasing population can be feed.

7. Discussions on sustainable nutrition and agriculture waste management was done and decision was taken on having regular training programmes for the farmers.

8. Discussions on utilization of less fertile land / Barren land for growing edible or cereal crops / energy crops such as jatropha etc for increasing the farming area was recommended.

9. Unconventional sources of energy should be researched and any energy crop of good quality or variety should be popularised among farmers.

10. To save biodiversity endangered species should be grown by tissue culture technique.

In Panel discussion Dr. V.K. Suri, Dr. V.P.S. Arora, Dr. Raguveer , Dr. Anil Sirohi, Dr. Bijendra Singh, Dr. R. S. Sengar, Dr. J.B. Singh etc. were participated. Vote of thanks given by Dr. Bijendra Singh

Day Third (10-10-2011)

Field Visit cum Academic Tour

Delegates and other participants have been arranged to visit two places, Hastinapur and Sardhana due to their historical significance. In Hastinapur major places i.e. Jain Temples, Jammu Dweep and farmer field were visited. Similarly in Sardhana, Sardhana Church and field of local farmers were visited.

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Volume 4(2) December 2011

Contents

RESEARCH PAPERS

1.	Information Technology and Rural Marketing	R H Dahiya	108-112
2.	Role and Regulation of Peptide Hormone in Plant Defense, Growth and Development	Rakesh Singh Sengar and Kalpana Sengar	113-124
3.	Effective Plant Regeneration in *Petunia Hybrida* from Corolla Derived Callus	Seema Singh, G. S. Virk, Zahoor A. Kaloo and Burhan M Padder	125-130
4.	Effect of Paraffin Liquid on Shelf Life and Sugar Content of Mango Fruits Cv. Dashehari	A.K. Tiwary and C.P. Singh	131-139
5.	Genetic Variability and Correlation Studies in *Gladiolus Hybrida* L. Under Tarai Condition	Prabhat Kumar, Ravi Kumar Maurya, Binayak Chakraborty, Rakesh Mer and D. S. Mishra	140-146
6.	Effect of Biofertilizer on Nodulation of Pea (*Pisum sativum* L.) in Alluvial Soil	Rajiv Kumar Singh, Ajay Rai, Saurabh Sharma, S.P. Singh and D.K. Srivastava	147-150
7.	Determination of Variability for Yield Advancement in Bottle Gourd [*Lagenaria siceraria* (Molina) Standl]	Yogesh Chandra Yadav and Sanjay Kumar	151-164
8.	Effect of Post Harvest Packaging Material and Calcium Treatments on the Quality of Guava During Storage	Rajesh Kumar, Shant Lal and Mohit Kumar	165-170
9.	Genetic Variability Studies in Onion (*Allium cepa* L.)	Navaldey Bharti, R.B. Ram, M.L. Meena and Yogita	171-175
10.	Studied the Interaction and Economics of Nitrogen and Phosphorus on Crop Growth, Relating Traits of Broccoli (*Brassica oleracea* L. Var. *italica*)	Dheerendra Katiyar, S.M.Tripathi, A.K Dwivedi and Vivek Pandey	176-180
11.	A Study of Infrastructural Profile and Constraints of Cut Flower Growers	Ravindra Kumar, Dan Singh, R.N. Yadav, D.K. Singh, V.K. Singh and Mukesh Kumar	181-186
12.	Association Analysis in Elite Germplasm Lines in Coriander (*Coriandrum sativum* L.)	Sanjive Kr. Singh, Senjam Jinus Singh, Devesh Singh and S.M. Tripathi	187-192
13.	Multiple Shoot Induction from the Shoot Tip Explants of *Cucurbita maxima*	Pankaj Chauhan, Aakansha Goswami, Swapanil Yadav and Aquil Ahmad	193-196

SHORT COMMUNICATION

14.	Efficacy of Bio Fertilizers in Potato (*Solanum tuberosum L)*	D.S. Chhonkar, Pushpendera Kumar and S.K. Shroti	197-201

15.	Studies on Effect of Bio fertilizers with Chemical Fertilizers on Growth and Yield of Cauliflower (*Brassica oleracea* Var. botrytis) Cv. Pusa Snowball K-1	Sanjay Kumar, Manoj Kumar Verma and Yogesh Chandra Yadav	202-205
16.	Impact of K.V.K. Training Programmes on Improvement in Skill of Trained Trainees With Respect to Horticulture and Agronomical Packages and Practices	Dan Singh, D.K.Singh, V.K.Singh R.N.Yadav and Ehandra Pal	206-209
17.	Studies on the Nutritive Value of Commercial Fruits	Shubhi Pandey	210-211
18.	Microbiological and Physico-Chemical Analysis of Wastewater of Ajanta Colony (Meerut) for Irrigation	R. Jakhar and S. Seh	212-214

Annals of Horticulture 4(2) : 108-112(2011) Hi-tech Horticultural Society

INFORMATION TECHNOLOGY AND RURAL MARKETING

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ABSTRACT

Strengthening agriculture is critical for facing the challenges of rural poverty, food insecurity, unemployment, and sustainability of natural resources. Accessible, transparent and remunerative markets are necessary to raise incomes and improve livelihoods of the rural poor. In developing countries, agricultural markets rarely meet these needs. In today's business marketplace, effective use and flow of information is the key to success. The global revolution in information and telecommunication technologies has created an opportunity to remedy the situation and to assist livestock producers, development practitioners, researchers and policy makers to make informed decisions and identify appropriate choices and strategies to cope with and mitigate the effects engendered by constraints in the pastoral livestock sub-sector. Information Technology (IT) is a strategic in the successful deployment of new technologies and the international competitiveness of agricultural producers. The main purpose of this paper is determination the role of information technology in improvement of rural marketing in Iran. Various ICT tools and techniques have been explored to acquire market. These tools include: Word Wide Web, Mobile Phones and Word Space Satellite Radio. The combination of theses technologies affords a unique opportunity to overcome the challenges in the remote areas.

Key words: information technology, rural management, ICT

Many of the developing countries have faced a complex set of challenges due to political and economic marginalization, inappropriate government policies, inadequate access to domestic and cross border markets, frequent and recurring droughts and other climate and environmental shocks. All these factors have led to a chronic food insecurity and high vulnerability in the areas inhabited by these communities, thereby threatening the livelihoods of millions of people (3).

Communication and access to information and knowledge are vital for the economic development, alleviation of hunger and the overall improvement of the livelihood of the developing countries (Jama, 2004). Access to information and improved communication is a crucial requirement for sustainable agricultural development. Modern communication technologies when applied to rural areas can help improve communication, increase participation, disseminate information and help share knowledge and skills. However it has been observed that the majority of rural population in Asian countries still has difficulty in accessing crucial information in order to make timely decisions. It is essential that information availability is demand driven rather than supply driven. The challenge is not only to improve the accessibility of communication technology to the rural population but also to improve its relevance to local development (5).

The global revolution in information and telecommunication technologies has created an opportunity to remedy the situation and to assist livestock producers, development practitioners, researchers and policy makers to make informed decisions and identify appropriate choices and strategies to cope with and mitigate the effects engendered by constraints in the pastoral livestock sub-sector (3).

INFORMATION TECHNOLOGY

Up until about ten years ago, nearly all data processing could be summed up in a single word: computers. Today, this term has given way to the broader descriptor *information technology*, which has become generally accepted. It refers to a rapidly expanding range of services, methods, techniques, applications, equipment, and electronic technologies used for the collection, manipulation, processing, classification, storage, and retrieval of recordable information and knowledge. At this time, such technologies include, but are not limited to, computers, software, high-capacity storage, networks, telecommunications, databases, multimedia, training, the internet and its world wide web, geographic information systems (GIS), online services, video conferencing, electronic mail, and expert systems: in short, all technologies related to the acquisition, storage, recovery, transfer, manipulation, and delivery of data, sound, and graphics, including video (7).

MARKETING

Marketing involves finding out what customers want and supplying it to them at a profit. This description stresses two crucial points that govern marketing i.e. firstly; the whole marketing process has to be customer oriented. Production must supply customers with what they want (or) need. Secondly, the marketing is a commercial process and is only sustainable, if it provides all the participants with a profit. Marketing can also be defined as the series of activities involved in making available services and information, which influence the desired level of production relative to market requirements, and the movement of the product (or commodity) from the point of production to the point of consumption. This definition covers the services such as providing information and advice. This role includes :(i) Finding out what the customer wants and (ii) Supplying him at a profit (5).

Marketing is the process of identifying and satisfying customers needs and providing them with adequate after sales service (1).

RURAL MARKETING

The rural agricultural production and consumption process plays a predominant role in developing countries. This has designed a new way for understanding a new process called Rural Marketing.

The concept of rural marketing has to be distinguished from Agricultural marketing. Rural marketing is different from agricultural marketing, which signifies marketing of rural products to the urban consumer or institutional markets. Rural marketing basically deals with delivering manufactured or processed inputs or services to rural producers, the demand for which is basically derived outcome. Rural marketing involves an urban to rural activity, which in turn is characterized by various peculiarities in terms of nature of market, products and processes. Rural marketing differs from agricultural or consumer products marketing in terms of the nature of transactions, which includes participants, products, modalities, norms and outcomes. The participants in case of rural marketing would also be different they include input manufacturers, dealers, farmers, opinion makers, government agencies and traders. The existing approach to the rural markets has viewed the markets as a homogeneous one, but in practice, there are significant buyer and user differences across regions as well as within that requires a differential treatment of the marketing problems. These differences could be in terms of the type of farmers, type of crops and other agro-climatic conditions (1).

INFORMATION TECHNOLOGY AND RURAL MARKETING IN IRAN

Accessible, transparent and remunerative markets are necessary to raise incomes and improve livelihoods of the rural poor. In developing countries, agricultural markets rarely meet these needs. The various causes that led to poor marketing of agricultural products in the developing countries are:

1.***Poor access to markets.*** Lack of competition among traders in rural areas contributes to monopolistic trading practices to the detriment of the poor and small producers. The development of micro-, small- and medium-enterprises (MSMEs) to facilitate the access of the poor to markets and enhance competition in rural areas is further constrained by a number of factors, which include lack of finance or the adequate availability of Business Development Services (BDS) to facilitate and guide the development of MSMEs. Moreover, such services are proving hard to sustain in rural areas and the ability of the poor to pay for them remains suspect.

2. ***Inadequately structured farmers associations*** that could interface with traders or could undertake marketing. These institutions either do not exist, or where they do, the organizations remain handicapped by: (a) low quality of and inexperienced, management; (b) under capitalised financial base; (c) limited access to capital; and (d) poorly paid staff. These constraints inhibit their ability to compete in the open market or adapt to changes in the marketing environment.

3. ***Stringent quality demands that add to costs of small producers without additional remuneration*** These are demanded by private sector buyers and are often backed by increased state regulation of food safety, origin and trading standards.

4. ***High transaction costs that affect the viability of the supply chains.***_Restricted physical access, transport services and market infrastructure in many rural areas, coupled with low volume of production that is often scattered, adds to the already high collection and transport costs, especially in remote areas. The supply chains in these areas are long with many intermediaries, which, of necessity, limit the amount that can be paid to smallholders.

5. ***Limited bargaining power*** of the producers and the lack of marketing credit often forces smallholders to sell produce just after harvest when the prices are low. This linked to asymmetric market and price information also hinders smallholders from realizing remunerative prices for their produce (2).

Some of the key tasks for design and review include:

1. ***Policy Adjustments to policies, regulatory frameworks and incentives*** are prerequisites for more efficient markets but practical progress could require alliances with other like-minded donors and discussions with Government.

2. ***Infrastructure*** 'Hard' items such as rural access roads, transport facilities and market infrastructure are likely to be the largest cost items in marketing projects.

3. ***Capacity building and provision of finance.*** To facilitate the operation of agreed policy and regulatory changes and enhanced participation of smallholders/disadvantaged groups in rural markets, the following may be necessary:

a.) Creation, training and support to producer associations/MSMEs to improve the bargaining power of small farmers.

b.) Promotion of MSMEs to facilitate access to markets.

c.) Technical innovation in agricultural products and processing; market research and promotion for new products.

d.) Provision of finance for marketing and processing.

e.) Where appropriate, strategies for up-stream distribution and market penetration.

f.) Investments in market information gathering and dissemination, including mass media, fax, telephone and real-time computer access systems.

In according to determination impact and role of information technology in improvement of rural marketing in Iran the factor analysis was used. Theses factors can be classified in five factors: communication-information, food processing, increasing production, managerial and marketing potentials.

One of the most important factors in improvement of rural marketing is marketing potentials. Information technology can improve situation of rural marketing in Iran in following ways:

1- Providing information about suitable **time** of selling of agricultural products
2- Providing information about suitable **place** of selling of agricultural products
3- Helping farmers **how** to sell their products
4- To get informed about suitable **price** of selling of agricultural products
5- Facilitation in accessing to **new markets**
6- Awareness of **current policies** in relation to market
7- Facilitation in accessing to **credit and production sources**
8- **Cheaper and faster commerce** of agricultural products

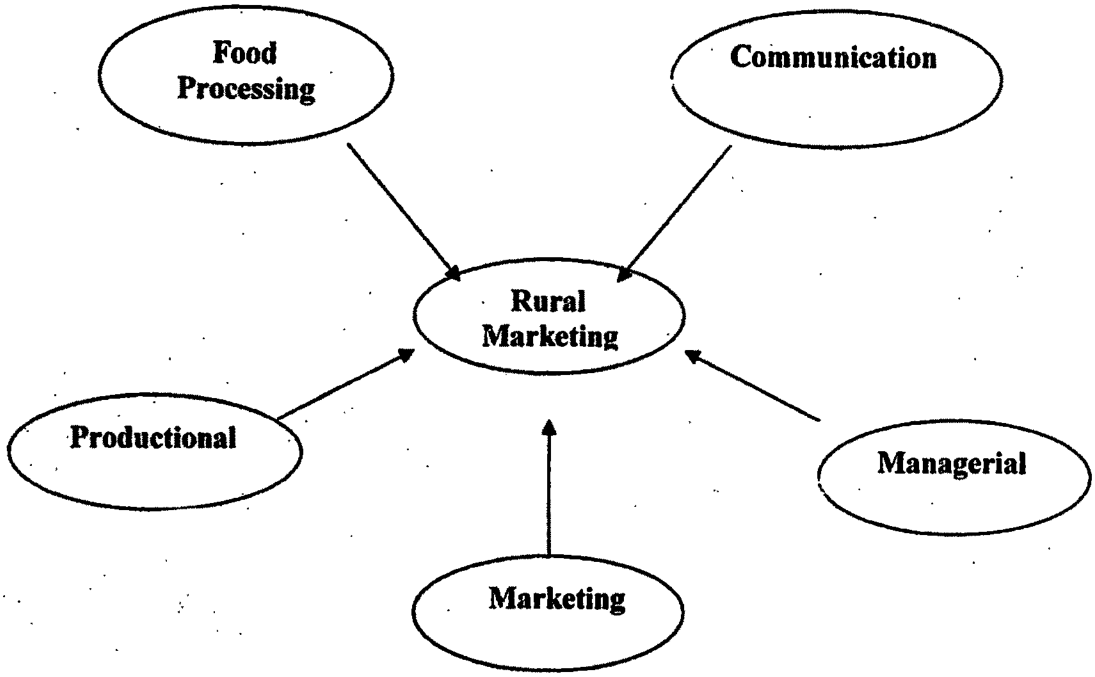

Figure1. Potential of information technology in improvement of rural marketing in Iran

As mentioned above, one of the key policies for problems solving of marketing in developing countries is investments in market information gathering and dissemination. Various ICT tools and techniques have been explored to acquire livestock market. These tools include:

i. Word Wide Web

The World Wide Web is as an important Internet tool to gather, organize and display livestock market information to be accessed from anywhere in the world with Internet capability. This technology is as a 2-way communication system where market monitors who have access to the technology can both enter data and receive reports on-line.

ii. Mobile Phones

Although mobile phone coverage is mostly limited to major cities, it is making rapid advances into pastoral areas in most of the developing countries. Therefore the use of cell phone SMS to report and deliver livestock price information to the potential beneficiaries in those areas is seen as a viable option. SMS is a means to send and to receive text messages (words, numbers or alphanumeric) to and from mobile phones or to and from computers via the Internet (E-mail) to mobile phones.

iii. WordSpace Satellite Radio

Another technology that has become beneficial to the livestock market information system is the WorldSpace radio technology. The only limitation with this technology is the fact that it is a one way communication. Unlike SMS technology, it is only useful for the dissemination of information to remote areas through the deployment of a mobile communication node (MCN). A MCN consists of a computer laptop, solar panel, adapter, portable printer; along with the WorldSpace satellite radio receiver. The information is downloaded and could be saved into a computer, so that national institutions can in turn print it and share it with the pastoral communities (3).

In summary, According to experts, four characteristics describe the powers of modern ICT in poverty reduction:

- Interactivity: For the first time ICTs are effective two-way communication technologies.

- Permanent Availability: The new ICTs are available 24 hours a day.
- Global reach: Geographic distances hardly matter any more.
- Cost-effective: For most areas the relative cost of communication has been shrunk to a fraction of previous values (4).

CONCLUSION

The challenge remains to be on how to collect livestock price information from the remote pastoral areas, analyze and report back to the communities in a timely manner for it to be meaningful in terms of trade, food security and early warning issues. The combination of Cell phone SMS and WorldSpace radios along with Internet affords a unique opportunity to overcome these challenges in the remote areas inhabited by the pastoral communities (3).

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P 35,457

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ROLE AND REGULATION OF PEPTIDE HORMONE IN PLANT DEFENSE, GROWTH AND DEVELOPMENT

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ABSTRACT

The biochemical machinery necessary for peptide synthesis, secretion, and posttranslational modification is present in every living cell. An enormous structural diversity can be generated by use of this preexisting cellular machinery. Not surprisingly, peptides are commonly used as signal molecules for intercellular communication in prokaryotes, fungi, and animals. These phytohormones are small diffusible molecules which were thought to be much better suited to penetrate the rigid cell walls between adjacent cells as compared to large peptide hormones. Research in recent years, however, has indicated that peptides may be widely used as chemical signals in plants as well. In the present work, I intend to summarize the evidence in support of this hypothesis. Cell to cell interaction is very important for the development of multicellular organization and for the function of most organ systems. Plant hormones play important roles in regulating developmental processes and signaling networks involved in plant responses to a wide range of biotic and abiotic stresses. Peptide signaling plays a greater than anticipated role in various aspects of plant growth and development. A substantial proportion of these peptides are secretory and act as local signals mediating cell-to-cell communication .Specific receptor for several peptides were identified as being memberane-localized receptor kinases, the largest family of receptor- like molecules in plants. Peptide hormones play very important role in plant signaling and plant defense.

Key words: peptide, plant hormones, plant signal, molecules.

In recent years, numerous biochemical and genetic studies have demonstrated that peptide signaling plays a greater than anticipated role in various aspects of plant growth and development.A substantial proportion of these peptide are secretory act as local signals mediating cell-to –cell communication. Specific receptor for several peptide were indentified as being membrane –localized receptor kinases , the largest family of receptor-like molecules in plant .These findings illustrate the importance of peptide signaling in the regulation of plant growth functions that were previously ascribed to the combined action of small lipohilic compounds referred to as " traditional plant hormones". Here, we outline recent advances in the current understanding of biologically active peptides in plants, currently regarded as a new class of plant hormones. In higher plants, cell to cell interaction is mainly mediated by small lipophillic compound such as auxins, cytokinin, gibberlin, abscisic acid, ethylene, brassinosteroids, and jasmonates. These compounds mediate comprehensive cell to cell communication in many developmental stages. Recent findings indicate that many secretory and nonsecretory peptide signals are also involved in various aspects of plant growth regulation including defense responses, callus growth , meristem organization, self –incompatibility (SI), root growth, leaf-shape regulation, nodule development , and organ abscission. Most of these peptides have been indentified by biochemical purification and genetic studies.Alsi, in silico genome analysis has revealed the presence of many genes encopding short open reading frames homologues toi these peptide.In this reviw , we summarize current knowledge about the structures, functions, genes, and signasls transduction properties of peptide hormones in plant , with a brief discussion about prospects for future studies of peptide ligands in plants.

Peptide hormones comprise a new class of hormones and are involved in the regulation of various aspects of plant growth and development including defence responses against attacking pathogens and pests (10). The peptide hormones are usually processed from larger polypeptide precursors. Examples of plant peptide hormones include systemin, hydroxyproline-rich glycopeptides, AtPep1, CLAVATA3, PHYTOSULFOKINE, POLARIS, ROTUNDIFOLIA4/ DEVIL1, inflorescence deficient in abscission gene (IDA), early nodulin 40 (ENOD40), nodule specific cysteine-rich (NCR), and S-locus cysteine-rich protein (SCR). Defence-related peptide hormones include systemin , hydroxyproline-rich glycopeptides systemins (12) from solanaceous plants and AtPep1 peptide from Arabidopsis (15). These peptides are from 18 to 23 amino acids in length, are processed from wound- and JA-inducible precursor proteins, and play roles in the activation of local and systemic responses against wounding and pest attack. Systemin is synthesized from prosystemin and stored in the cytoplasm (13). In contrast, hydroxyproline-rich glycopeptides systemins are processed from precursors that are synthesized through the secretory pathway and localized in the cell walls (14). Initially, systemin was considered to be the systemic signal responsible for the activation of systemic defence responses against wounding and herbivore attack (16). However, recent grafting experiments with JA biosynthetic and perception mutants indicate that the systemic signal is likely to be derived from the octadecanoid pathway but not necessarily JA itself (18) because neither JA nor systemin is needed in the systemic, undamaged leaves of tomato plants. This suggests that systemin acts at or near the site of wounding by inducing and amplifying the JA-derived mobile signal and activates the systemic response (19). Systemin regulates the expression of several genes involved in the octadecanoid pathway and herbivore defence in tomato (20). Tomato plants overexpressing prosystemin show enhanced resistance whereas plants with reduced systemin levels show more susceptibility to insect herbivory (21). Likewise, overexpression of the tobacco hydroxyprolinerich glycopeptide precursor gene resulted in the activation of proteinase inhibitor genes and increased resistance to feeding by Helicoverpa armigera larvae in tobacco (22). Both systemin and hydroxyproline-rich glycopeptides can activate the expression of anti-herbivore proteinase inhibitors and polyphenol oxidase in response to wounding and methyl jasmonate. AtPep1, a 23 amino acid peptide derived from precursor PROPEP1 in Arabidopsis, acts as an elicitor and activates the expression of defence related genes (15). The gene encoding the precursor can be induced by wounding, methyl jasmonate, ethylene and SA. Constitutive expression of PROPEP1 gene in Arabidopsis results in the constitutive transcription of PDF1.2 and enhanced resistance to P. irregular (23). These results suggest that defense-signaling peptides play important roles in the activation of defence against invaders probably by amplifying the signal initiated by wounding and elicitors.

However, the underlying molecular mechanism involved in the activation of these peptide hormones in regulating plant defence remains elusive.

Classes of peptide hormones and their structure and functioning

Peptide signaling plays a significant role in various aspects of plant growth and development and specific receptors for various peptides have been identified as being membrane-localized receptor kinases, the largest family of receptor-like molecules in plants. Signaling peptides include members of the following protein families. Three distinct biosynthetic pathways of secreted peptide hormones categorized by their structural characteristics (fig 1). Secreted peptide hormones can be categorized into the following three groups: peptides involving complex post-translational modifications followed by extensive proteolytic processing; peptides involving intramolecular disulfide bond formation followed by proteolytic processing; and peptides involving multiple intramolecular disulfide bonds without proteolytic processing. The first group of peptides are called small post-translationally modified peptides; the latter two groups are defined as cysteine-rich peptides.

Systemin - is a small polypeptide functioning as a long-distance signal to activate chemical defenses against herbivores. It was the first plant hormone proven to be a peptide. Systemin induces the production of protein defense compound called protease inhibitors. Systemin was first identified in tomato leaves. It was found to be an 18-amino acid peptide processed from the C-terminus of a 200-amino acid precursor, which is called prosystemin.

CLV3/ESR-related ('CLE') peptide family - *CLV3* encodes a small secreted peptide that functions as a short range ligand to the membrane-bound CLV1 receptor like kinase that together with CLV2 (a receptor-like protein) function to maintain stem cell homeostasis in *Arabidopsis* shoot apical meristems. Although the maize embryo-surrounding region protein (ESR) (24) and CLV3 are very different, they are both members of the CLE peptide family given that they share a short conserved 14-amino acid sequence at the carboxy terminal region (25). To date, more than 150 CLE signaling peptides are identified (26 & 27). This proteolytically processed bioactive region is important for both promoting and inhibiting cellular differentiation in both apical and cambial meristems (28).

ENOD 40- is an early nodulin gene, hence ENOD, that putatively encodes two small peptides, one of 12 and the other of 18 amino acid residues. Controversy exists on whether the mRNA or peptides themselves are responsible for bioactivity (29, 30, 31,32) . Both peptides have been shown " in vivo" to bind to the 93 kDa subunit of sucrose synthase, an essential component in sucrose metabolism (34). Sucrose degradation is a key step in nitrogen fixation, and is a pre-requisite for normal nodule development.

Phytosulfokine (PSK) - was first identified as a "conditioning factor" in asparagus and carrot cell cultures (35 & 36). The bioactive five amino acid peptide (PSK) is proteolytically processed from an ~80 amino acid precursor secreted peptide (Yang 1999). PSK has been demonstrated to promote cellular proliferation and transdifferentiation. It has been demonstrated that PSK binds to a membrane bound LRR receptor like kinase (PSKR) (38).

POLARIS (PLS) - The PLS peptide has a predicted length of 36 amino acids however possesses no secretion signal, suggesting that it functions within the cytoplasm. The PLS peptide itself has not yet been biochemically isolated, however loss-of-function mutants are hypersensitive to cytokinin with reduced responsiveness to auxin. Developmentally it is involved in vascularization, longitudinal cell expansion and increased radial expansion (39).

Rapid Alkalinization Factor (RALF) - is 49 amino acid peptide that was identified whilst purifying systemin from tobacco leaves, it causes rapid medium alkanalization and does not activate defence responses like systemin (40). Tomato RALF precursor cDNA encodes a 115 amino acid polypeptide containing an amino-terminal signal sequence with the bioactive RALF peptide encoded at the carboxy terminus. It is not known how mature RALF peptide is produced from its precursor, but a dibasic amino acid motif (typical of recognition sites of processing enzymes in yeast and animals) is located two residues upstream from the amino terminus of mature RALF. RALF has been identified to bind to potential membrane bound receptors complex containing proteins 25 kDa and 120 kDa in size (41).

SCR/SP11- are small polymorphic peptides produced by the tapetal cells of anthers and is involved in self-incompatibility of *Brassica* species (42, 43, 44). This secreted polypeptide is between 78 and 80 amino acid residues in length. Unlike other peptide hormones, no further post-translational processing occurs, except for the removal of the N-terminal signal peptide. SCR/SP11 like other small peptide hormones binds to a membrane bound LRR receptor like kinase (SRK) (45, 46).

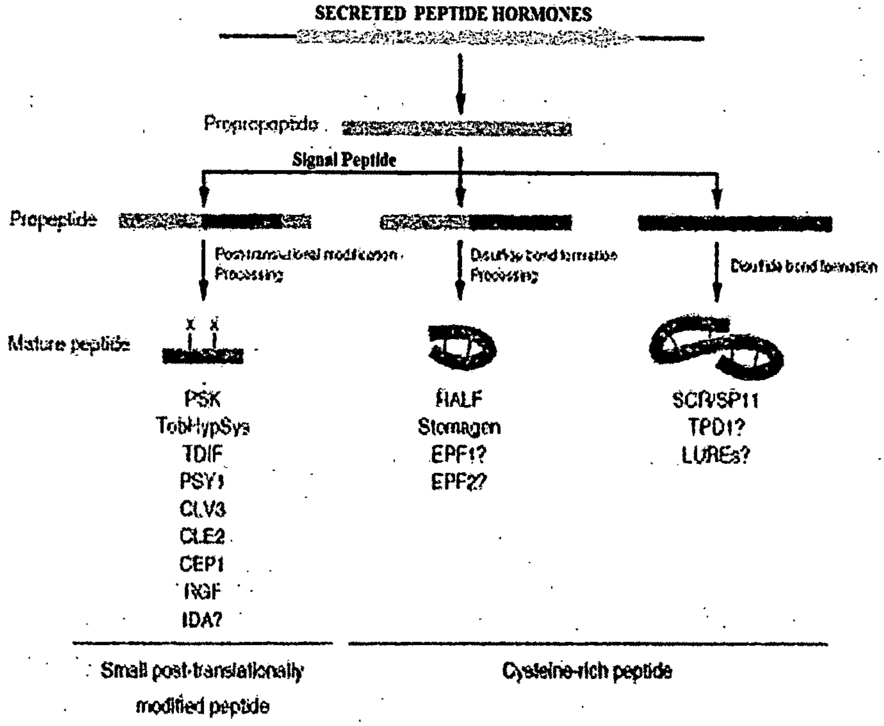
ROTUNDIFOLIA4/DEVIL1 *(ROT4/DVL1)* - The ROT4 and DVL1 are peptides of 53 and 51 amino acids respectively, which have a high degree of sequence homology. They are /two members of 23 member peptide family. ROT4 and DVL1 are involved in regulating polar cell proliferation on the longitudinal axis of organs (47, 48).

Inflorescence deficient in abscission (IDA) - a family of secreted peptides identified to be involved in petal abscission. The peptides are 77 amino acids in length and possess an amino-terminal secretions signal. Like the CLE peptide family these proteins have a conserved carboxy-terminal domain that is bordered by potentially cleavable basic residues. These proteins are secreted from cells in the floral abscission zone (49). Studies suggest that the HAESA membrane-associated LRR-RLK is likely to be this peptide's receptor as it too is expressed in the zone of floral organ abscission (50).

Post-Translational Processing and Modifications

Some protein must be modified in one or more ways before they can function in their mature active form.Hydroxylation , tyrosine sulfation, and glycosylation have been observed as post – translation modification of plant secretory peptides. 4- hydroxylproline has been detected in many plant glycoprotein, including extensins, proline-rich glycoprotein, and arabinogalactan preotein. This modification is necessary for glycosylation of proline residues.Formation of 4-hydroxyproline in protein is catalyzed by the prolyl 4 hydroxylases localized in both the ER and Golgi apparatus .Recent amino acid substitution analysis revealed that hydroxylation of proline residues require the 5 amino acid sequence [AVSTG]-Pro-[AVST]-[GAVPSTC]-[APS or acidic], although several single –amino acid substitution are compatible with hydroxylation of proline .The pro-pro-gly repeat and poly pro are also preferentially hydroxylated by these enzymes.

Fig 1 biosynthetic pathway of peptide secretion



PSK, several systemins, and RALF, which are derived from larger precursor peptides, are apparently produced via the above –described post translational processing pathway.Sequence alignment of known PSK precursors derived from a variety of plant species indicates that the 5amino acid PSK domain is located near the C terminal of the precursors, and that a single –or double –basic amino acid motif is located several residues upstream from the 5 amino acid PSK domain (typically at aa-8, relative to the first residues of PSK). This basic motif is perfectly conserved in all PSK precursors, strongly suggesting that initial cleavage occurs at that point .However, subsequent aminopeptidase and carboxypeptidase cleavage is required to remove residual N-terminal extensions and C-terminal tails and thus produce mature PSK. These proposed PSK processing mechanism sharply contrast with those of animal peptide hormones, in which the mature peptide is usually generated after initial processing on the C-terminal side of a group of basic amino acids and subsequent simple removal of terminal basic residues by carboxypeptides.It is also unclear how these exopeptides remove residiual amino acids to specifically yield 5-amino acid PSK. ubtilases have greater structural similarity with prokaryotic degrading –type subtilases than with animal processing –type subtilases , due to the lack of the p-domain characteristic of the animal enzymes. CLV3/CLE and IDA/IDL peptide have a conserved domain flanked by basic amino acid residue near their C terminal , but there is marked intrafamily sequence diversity in other domains, which is similar to the intrafamily sequence diversity of PSK precursor peptides.

These sequence characteristics strongly suggest that small peptides encoded within the Cterminal conserved domain act as ligand for corresponding receptors. Biochemical identification of the mature sequence of these small peptides and characterization of their ligand –receptor interaction are needed to determine whether these putative secretory peptide function as hormones. One possibility is that the PSK domain escapes proteolysis due to sulfate modification of tryosines, which often confers resistance to proteolytic digestion. Post translational processing of plant peptide hormones may involve regulatory mechanisms that are more complex than those of animals. Plant s One Cell-to-cell signaling mediated by secreted signals and membrane-localized receptors is one of the critical mechanisms by which growth and development of multicellular organisms are cooperatively regulated. Upon binding of signals to the extracellular domain of receptors, these physicochemical inputs are converted into physiological outputs activating downstream signaling that modulates cellular functions and fates through conformational changes in the receptors triggered by signal binding. Signal molecules that specifically bind receptors are generally referred to as ligands. Because membrane-localized receptors act as master switches of complex intracellular signaling, identification of the ligand–receptor pair is one of the central issues of post-genome research.

In higher plants, a number of genes encoding small secreted peptides have been identified in Arabidopsis (1, 2, 3) and a certain proportion of their products are expected to comprise candidates for ligands (i.e. hormones). One structurally characteristic group of these peptide hormones comprises small post-translationally modified peptides, including phytosulfokine (PSK) (4), PSY1 (Amano et al 2007), tracheary element differentiation inhibitory factor (TDIF) (7), CLAVATA3 (CLV3) (8, 6) and root meristem growth factor (RGF) (10) (Table 1). Modifications of these peptides, such as post-translational sulfation, hydroxylation and arabinosylation, are important for their function.

Table 1 Post-translationally modified peptide hormones in plants

Peptide	**Mature peptide structure**
PSK	**Tyr(SO 3 H)** -Ile- **Tyr(SO 3 H)** -Thr-Gln
PSY1	Asp- **Tyr(SO 3 H)** -Gly-Asp-Pro-Ser-Ala-Asn-Pro-Lys-His-Asp-Pro-Gly-Val- **[(L -Ara) 3]Hyp** - **Hyp** –Ser
TDIF	His-Glu-Val- **Hyp** -Ser-Gly- **Hyp** -Asn-Pro-Ile-Ser-Asn
CLV3	Arg-Thr-Val- **Hyp** -Ser-Gly- **[(L -Ara) 3]Hyp** -Asp-Pro-Leu-His-His-His
CLE2	Arg-Leu-Ser- **Hyp** -Gly-Gly- **[(L -Ara) 3]Hyp** -Asp-Pro-Gln-His-His
CEP1	Asp-Phe-Arg- **Hyp** -Thr-Asn-Pro-Gly-Asn-Ser- **Hyp** -Gly-Val-Gly-His
RGF1	Asp- **Tyr(SO 3 H)** -Ser-Asn-Pro-Gly-His-His-Pro- **Hyp** -Arg-His-Asn

In a classical research approach, candidates of hormones have been identified by repeated purifications based on their specific biological activities. The feasibility of using this approach, however, largely depends on the quality and sensitivity of the bioassay system.

Another major limitation of this approach is the lack of an established bioassay system to detect peptide hormones with an unexpected class of functions. In this context, an alternative strategy for identification of novel hormones is needed to overcome limitations of bioassay-based approaches.

From a structural point of view, small post-translationally modified peptides are produced through a secretory pathway after post-translational modification and then proteolytic processing. These processes involve at least two enzymes, namely a post-translational modification enzyme and a proteolytic processing enzyme. Post-translational modification also requires co-substrates such as the sulfation donor PAPS and the arabinosylation donor UDP-l-arabinose synthesized using ATP. Thus, biosynthesis of small post-translationally modified peptides requires considerably higher energy compared with normal proteins and peptides. Nevertheless, a number of post-translationally modified peptides have been evolutionarily conserved, suggesting that these 'expensive' modified peptides afford physiological merits to the plants greater than their energy costs. In this context, post-translational modifications (as well as proteolytic processing) can be indicative of biologically active peptides. Indeed, the peptidomics approach targeting sulfated peptides has successfully identified a novel peptide hormone, PSY1 (5), and an in silico gene screening approach has uncovered a Hyp-containing peptide hormone candidate, CEP1 (3). Thus, post-translationally modified peptides appear to be good candidates for peptide hormones.

Another important aspect of post-translationally modified peptide research involves phenotypic analysis of loss-of- function mutants of post-translational modification enzymes. Because post-translational modification enzymes recognize particular sequences within multiple target peptides, their loss of function should be reflected as deficiencies in the biosynthesis of modified peptides. Thus, the presence of novel post-translationally modified peptide hormones should be revealed through phenotypic analysis of such mutants. Indeed, a novel peptide hormone, RGF1, was successfully identified by a search of the sulfated peptide(s) that recovers root meristem defects of the *tpst-1* mutant (10). In this context, identification of hydroxyproline arabinosyltransferase, followed by phenotypic analysis of loss-of-function mutants of this enzyme, could provide a clearer picture of the functions of arabinosylated peptide hormones in plants.

Gene encoding putative small secretory peptide.The seequencing of plant geomes has produced information that is useful for indentifying genes with putative small ORFs.In addition , prediction of secretory protein has been facilitated by advances in bioinformatics technology such as web-based programms including signalP, TargetP and PSORT.Several genes encoding putative small secretory peptide have been identified using a combination of these computational techniques.RALFLs are an example of genes that have been identified using such in silico methods.RALFLs were identical during a systematic search for short secretory peptide involving examination of records of all predicted protein from Arabidopsis chromosomes 2 and 4.Using signalP, annotated putative protein with a length of less than 200 amino acids were analyzed for the presence of a signal peptide.Protein likely to contain a signal peptide were further analyzed using BLAST (basic local alignment search tool) as part of the search for additional homologous sequence in arabidopsis.

An advantage of the above approach is that novel genes encoding small secretory peptide can be identified irresepective of their functional redundancy and phenotypes

.However, this methodology is only applicable to gene families in which at least one member has been annotated, and in studies using this method , small genes encoding peptides are frequently overlooked by prediction programs.In fact, 20 of the 34 known RALFL genes have not been annotated, and have only been identified in TBLASTN searches of the C-terminal conserved region of RALFLs,Given the recent improvements in the prediction accuracy of gene prediction programs, it appears that in silico method will continue to aid identification of secretory peptides.

Exogenous Peptide Signals

Plants, being sessile organisms, have to be able to adapt to the everchanging environment with appropriate biochemical responses. A prerequisite for adaptation is the ability to perceive these changes which include biotic as well as abiotic stress factors. Microbial infection is a particularly threatening form of biotic stress. Consequently, plants have evolved to sense the presence of a pathogen and to react to infection with appropriate defense responses including the development of resistance. Hence, a surveillance system must be present which - similar to the phenomenon of self-incompatibility (discussed above) - allows the distinction between "self" and "non-self". Two types of resistance are known and are referred to as general and race-specific resistance, respectively. For the induction of a general resistance response, a structure has to be recognized by the plant cell that is absent from plant cells but common to a wide range of microorganisms. In contrast, racespecific resistance depends on the presence of a specific protein in a certain race only of a microbial species (*i.e.* the avirulence (*avr*) gene product) and a corresponding protein in the resistant plant species (*i.e.* the resistance gene product). This type of interaction is described by the gene-for-gene concept. In general resistance and in race-specific resistance as well, it is a molecule produced by the microorgnism (or generated by an enzyme produced by the microorganism) that is recognized by the plant cell as being foreign, followed by the induction of a response. Such molecules have been referred to as elicitors. Elicitors can be (poly)peptides, carbohydrates, lipids, small secondary products, or a combination thereof. The structural diversity of elicitors is immense and beyond the scope and intention of this review. Thus, the following discussion will be restricted to microbial (poly) peptide elicitors of plant pathogen resistance and will focus on a few examples that are most instructive in demonstrating the underlying principles.

Conclusion

The examination of general and race-specific elicitors of plant defense reactions revealed that plant cells are able to perceive a large number of structurally diverse peptide signals. It seems likely that during evolution the machinery to perceive and transduce exogenous peptide signals was not generated *de novo* but was rather recruited from pre-existing cellular signaling components. Thus, the recognition of exogenous peptide elicitors by the plant cell may indicate the presence of endogenous peptide signals and the corresponding signal perception/transduction machinery. The structural similarity between CLV1, a LRR-RLK involved in meristem maintenance, and FLS2 or Xa21, *i.e.* the putative receptors of exogenous peptide elicitors, provides support for this hypothesis. Likewise, structural similarity was observed between the resistance gene product Cf-9 and CLV2. Both proteins have been suggested to be part of a receptor complex and contain LRRs likely to provide the ligand binding sites. Hence, LRRs appear to be versatile perception modules for extracellular and intracellular elicitors as well as for endogenous peptide signals. In some cases, structural similarity is not restricted to the perception system for exogenous and endogenous peptides but rather extends to the signals themselves. The AVR9 peptide elicitor and SCR, the male determinant of self-incompatibility in *Brassica*, for example, are both small cysteine-rich proteins in which disulfide bridges provide a rigid structural scaffold for exposed surface loops. A comparison of systemin, an endogenous peptide signal for plant defense, with peptide elicitors of general resistance shows that even the initial cellular responses are highly similar. These observations, in addition to the presence *in planta* of receptor-like kinases and processing proteases as indirect evidence for a general role of peptide signals in intercellular communication in plants, all seem to indicate that the plant peptide signals identified thus far may just be the tip of the iceberg. Obviously, we are just beginning to unravel the complexity of peptide signaling in higher plants. The years to come will likely see the identification of new peptide signals as regulators of plant growth and development and promise exciting new discoveries in the elucidation of both signal perception and cellular responses.

Peptide signaling in plant was not in focus due to important role of six lipophilic nonpeptide plant hormones in plant growth and development . Peptides also play important roles in intercellular and intracellular signaling in plants. The current research aimed at identification of novel peptide ligands and their signal transduction pathway should eventually produce a paradigm for hormone function in plants, and will clarify the differences and similarities in peptide signal transduction between plants and animals. In addition to lipophillic nonpeptide plant hormones, recent finding indicates that many secretory and non-secretory peptide signals are involved in various aspects of plant growth regulation. Some secretory peptide undergo post translational processing and / or modification before secretion. Sequencing of plant genomes has revealed the presence of many genes with putative small open reading frames encoding secretory and non secretory peptides with unknown function.

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EFFECTIVE PLANT REGENERATION IN *PETUNIA HYBRIDA* FROM COROLLA DERIVED CALLUS

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ABSTRACT

Calli were induced from corolla explants of *Petunia hybrida* var. Nana Compacta on MS medium supplemented with both auxins and cytokinins. Among the auxins, NAA (10.7µM/l) was most effective in inducing a white and creamy callus. Maximum callus multiplication rates (34.7%) were observed on MS medium supplemented with 10.7µM/l NAA.16-18 shoots were induced from the corolla derived callus on MS medium supplemented with 8.9µM/l BA. The regenerated shoots formed roots when cultured on MS medium supplemented with a combination of 5.4µM/l NAA + 4.9µM/l IBA . Young plantlets were successfully transferred to community pots for field evaluations.

Key Words: *Petunia hybrida,* auxins, callus induction, corolla explants, root formation.

Plant cell tissue and organ culture techniques have tremendous potential for horticultural plant amelioration and mass propagation. *Petunia hybrida* Hort (Vilm) is one of the most important annual ornamental plants of the modern world. The range of flower color, shape and size is incredible and can be effectively used in different landscapes, designs and forms. In the international market for ornamentals there is an increasing demand for double Petunias which are large sized, brightly coloured, sturdy and of high horticultural importance. However, production of double Petunias through breeding is labour oriented and an expensive process. All the double flowers are female sterile. The propagation of double Petunias through *in vitro* techniques would be of great help to the flourishing floriculture industry. In the present paper, efforts were made to study the comparative effects of different growth regulators individually and in various combinations with respect to their effect on callus induction, callus multiplication, shoot multiplication, rooting and acclimatization of the regenerated plantlets to the external environmental conditions.

MATERIALS AND METHODS

*Petunia hybrid*a var. Nana Compacta seeds were obtained from Indo American Hybrid Seeds Bangaluru. These seeds were raised in seed pans in the green houses. For the corolla explants the unopened flower buds were surface sterilized with sodium hypochlorite at a concentration of 1% and time duration of 5-10 mins. After repeated and thorough washings with double distilled water the petals were cut into small segments of 4-5 mm each.

MS medium was prepared, pH was adjusted to 5.8 with 1NNaOH, various auxins such as 2, 4-D, NAA, IBA and IAA; cytokinins such as BA and Kinetin were added in the required concentrations before autoclaving the medium at 121°c for 25 mins. MS medium (6) without any growth regulators was used as a control. After inoculation with corolla explants the cultures were incubated at 25±2°c with 16 hours photoperiod under fluorescent light.

Healthy white and creamy calli were excised from the explants and transferred to MS medium supplemented with various auxins and cytokinins. Mature shoots were transferred to MS medium supplemented with NAA and IAA at different concentrations for rooting. Young plantlets were then successfully transferred to community pots.Three replicates were conducted of each experiment and each experiment was then statistically analyzed using ANOVA.

RESULTS AND DISCUSSION

Calli initiated from corolla explants treated with all the auxins examined, however no callus initiated on corolla explants cultured on control. Auxins in culture induced calliproliferation shoot differentiation and root formation. Among the auxins tried independently NAA (10.7μM/l) gave the highest callus induction percentage (88.88%) (Table 1).

Table 1: Effect of NAA on callus induction from Corolla explant of *Petunia hybrida* var. Nana Compacta (double) (20 days after inoculation).

Plant growth regulator (μM/l)	No. of cultures forming callus*	Per cent callus induction $\bar{X}$±SE
NAA	Nana Compacta (double)	Nana Compacta (double)
5.4	50	69.44±0.57
8.1	55	76.38±0.57
10.7	64	88.88±0.57
13.4	–	–
16.1	–	–
		df=2,x^2=1.787

Data shown are mean ± SE of three experiments, each experiment consisted of 24 replicates
* out of 72 culture inoculated.

2,4-D also induced callusing at 6.8μM/l (83.33%). IAA was effective at a concentration of 11.4 μM/l (73.61%).Among the cytokinins BA at a concentration of 8.9 μM/l induced maximum callus induction (87.50%)(Table 2)while Kinetin at a concentration of 9.3μM/l induced 83.33% callus induction.

Table 2: Effect of BA on callus induction from Corolla explant of *Petunia hybrida* var. Nana Compacta (double) (11 days after inoculation).

Plant growth regulator (μM/l)	No. of cultures forming callus*	Per cent callus induction $\bar{X}$±SE
BA	Nana Compacta (double)	Nana Compacta (double)
4.4	56	77.77±0.57
6.6	60	83.33±2.0
8.9	63	87.50±2.0
11.1	58	80.55±1.52
13.3	56	77.77±1.15
		df=4,x^2=0.601

Data shown are mean ± SE of three experiments, each experiment consisted of 24 replicates
* out of 72 culture inoculated.

BA and various auxins like 2, 4-D, NAA, IAA and IBA were tried in different combinations to study their effect on callus induction. A combination of BA 8.9μM/l + 2, 4-D 6.8μM/l induced callus induction (87.50 %) 10 days after inoculation (Table3).

Table 3: Combined effect of BA and 2,4–D on callus induction from Corolla explant of *Petunia hybrida* var. Nana Compacta (double) (10 days after inoculation).

Plant growth regulator (μM/l)		No. of cultures forming callus*	Per cent callus induction $\bar{X}$±SE
BA	2,4–D	Nana Compacta (double)	Nana Compacta (double)
8.9	4.5	60	83.33±1.0
8.9	6.8	63	87.50±1.0
8.9	9.0	–	–
8.9	11.3	–	–
8.9	13.6	–	–
			df=1,x^2=0.073

Data shown are mean ± SE of three experiments, each experiment consisted of 24 replicates
* out of 72 culture inoculated.

Kinetin 9.3 μM/l was most suitable for callus induction (88.88%) when used in combination with NAA at a concentration of 10.7μM/l (Table 4).

Table 4: Combined effect of KN and NAA on callus induction from Corolla explant of *Petu hybrida* var.Nana Compacta (double) (18 days after inoculation).

Plant growth regulator (μM/l)		No. of cultures forming callus*	Per cent callus induction $\bar{X}$±SE
KN	NAA	Nana Compacta (double)	Nana Compacta (double)
9.3	5.4	53	73.61±1.15
9.3	8.1	57	79.16±1.0
9.3	10.7	64	88.88±0.57
9.3	13.4	50	69.44±1.15
9.3	16.1	45	62.50±1.0
			df=4,x^2=3.844

Data shown are mean ± SE of three experiments; each experiment consisted of 24 replicates
* out of 72 culture inoculated.

All concentrations of BA and KN induced shoot differentiation. It was optimum (72.2%) at a combination of BA 8.9 µM/l + KN 9.3µM/l, this combination also gave the maximum number of shoots per unit culture (18 shoots) (Table5).

Table 5: Combined effect of BA and Kinetin on shoot differentiation from Corolla derived Callus of *Petunia hybrida* var. Nana Compacta (double) after 13 days of subculturing.

Plant growth regulators (µM/l)		No. of cultures showing shoot differentiation	Per cent shoot differentiation	No. of shoots per culture	Height of shoots (cm)
BA	KN		$\bar{X}$±SE	$\bar{X}$±SE	$\bar{X}$±SE
8.9	4.6	38	52.7±2.0	9.94±0.47	2.16±0.07
8.9	7	45	62.5±2.0	14.0±0.53	2.49±0.10
8.9	9.3	52	72.2±1.15	18.07±0.47	2.85±0.15
8.9	11.6	50	69.4±1.15	15.93±0.47	2.63±0.13
8.9	13.9	42	58.3±1.0	13.0±0.50	2.20±0.05
			df = 4; χ^2 = 2.890	$F_{(df4,222)}$ = 550.97; HSD = 0.498	$F_{(df4,222)}$ = 96.47; HSD = 0.114

Data shown are mean ± SE of three experiments; each experiment consisted of 24 replicates
* out of 72 culture inoculated.

For the induction of rooting NAA 5.4 µM/l was found to be optimum (75.0%) with 8-9 roots per explant, followed by NAA 8.1µM/l (70.8%) (Table 6). The response was very slow with IBA (38.8%) at a concentration of 12.3 µM/l and only 2 roots per explant. After 3 weeks of root formation the plantlets were hardened and transferred to community pots.

Table 6: Effect of NAA on root induction from young shoots of *Petunia hybrida*var. Nana Compacta (double) after 18 days of inoculation.

Plant growth regulators (µM/l)	No. of cultures showing root induction	Per cent root induction	No. of roots per culture	Length of roots (cm)
NAA		$\bar{X}$±SE	$\bar{X}$±SE	$\bar{X}$±SE
5.4	54	75.0±1.0	8.66±1.06	2.55±0.08
8.1	51	70.8±1.15	5.45±0.92	1.89±0.12
10.7	50	69.4±1.0	4.94±0.76	1.69±0.15
13.4	46	63.8±0.57	4.52±0.66	1.67±0.09
16.1	43	59.7±1.15	4.02±0.49	1.54±0.09
		df = 4; χ^2 = 1.533	$F_{(df4,239)}$ = 83.24; HSD = 0.7985	$F_{(df4,239)}$ = 207.58; HSD = 0.1099

Data shown are mean ± SE of three experiments; each experiment consisted of 24 replicates

* out of 72 culture inoculated.

Auxins are very important for the induction of callus from a variety of tissues except cambial tissues, which can proliferate without exogenous supply of auxins. 2,4-D has been mainly used for callus induction in Petunia (8). Auxins such as IAA caused limited callusing (8). Studies in Petunia by (3) on uptake and metabolism of auxins reported that the auxins followed different metabolic courses. IAA was metabolized very slowly as compared to other auxins and was often referred to as a slow release hormone. (9) reported induction of Petunia corolla senescence by ethylene and suppression by cytokinins. Ethylene production which induced corolla senescence also promoted inactivation of cytokinins (10) showed petunia flower colours were mainly due to the presence of the flavonoids. For commercialization it was necessary to generate independent transgenic lines, select elite lines with suitable phenotypes and maintain them in tissue culture.

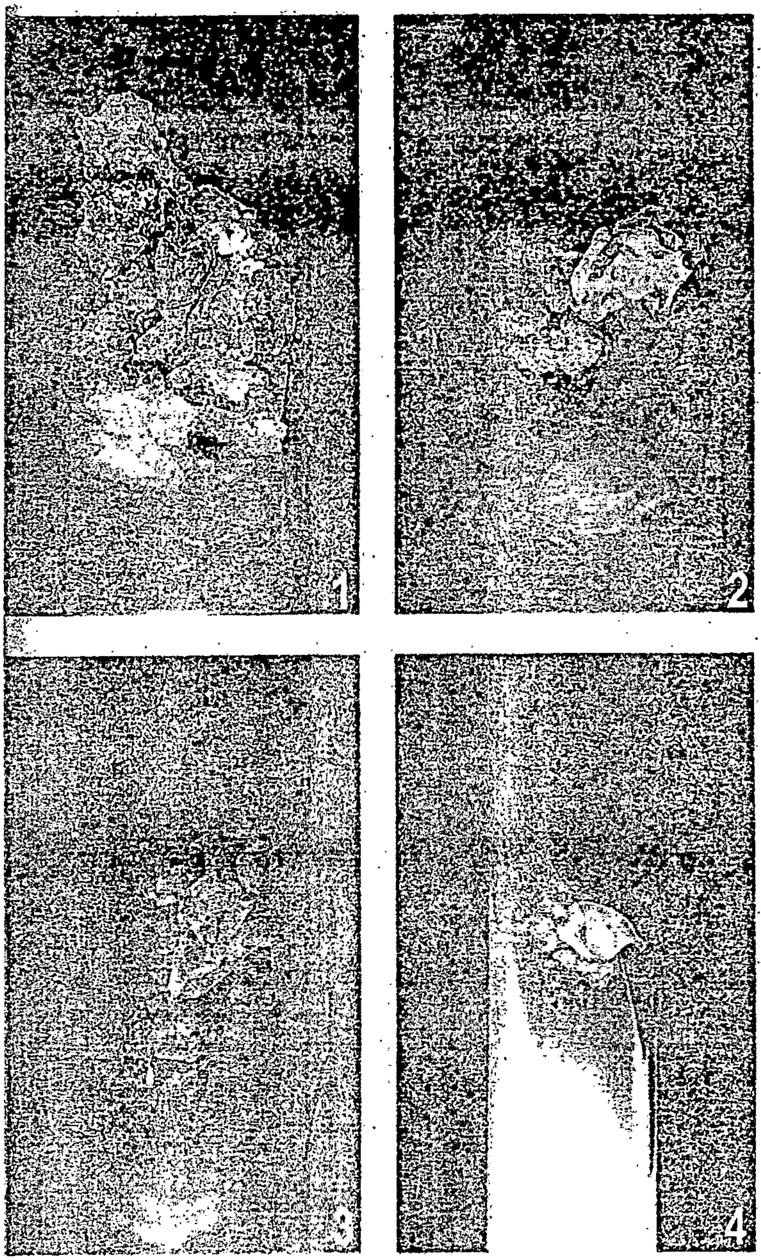

PLATE VII

1. Effect of 2,4-D (6.8µM/l) on corolla explants of Nana Compacta showing white and creamy callus.
2. Effect of BA(8.9µM/l) on corolla explants of Nana Compacta showing green and compact callus.
3. Combined effect of BA 8.9µM/l+ NAA 10.7µM/l on corolla explants of Nana Compacta showing green and compact callus.
4. Combined effect of Kn 9.3µM/l+ IBA 9.8µM/l on corolla explants of Nana Compacta showing creamy compact callus.

(1) studied effect of different levels of NAA and BA on shoot multiplication and regeneration of Petunia hybrida using leaf explants. Highest shoot regeneration was observed on MS medium supplemented with 2mgl^{-1} BA. (7) used a range of explant types to obtain adventitious shoot regeneration from seven commercial strawberry cultivars. (5) represented Petunia as a model system for comparative research.

Hence Petunia model system provides a dynamic and cooperative research platform combining excellent technical features with a broad range of research possibilities.

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EFFECT OF PARAFFIN LIQUID ON SHELF LIFE AND SUGAR CONTENT OF MANGO FRUITS CV. DASHEHARI

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ABSTRACT

The present investigation was undertaken to evaluate the effect of paraffin liquid on shelf life and changes in sugar content of mango (*Mangifera indica* L.) cv. Dashehari during storage period at ambient conditions. The experiment was laid out in Completely Randomized Design with total 9 treatments and three replications. Pooled data of 2009 and 2010 showed that shelf life of whole fruit coated with 8% paraffin liquid could be maintained up to 13 days as compared to without fruit stalk uncoated fruits (7 days) treated as control. The mangoes were analyzed from the day of harvest to 14th day of harvest. Total sugar contents of whole fruit coated with 8% paraffin liquid were found up to 18.54% on 12th day. Similarly higher reducing sugar and non reducing sugar contents were found in whole fruit coated with 8% paraffin liquid having values 7.58% and 10.41% both on 12th day, respectively. All the three sugar contents on the day of harvest were found minimum.

Key words: Shelf life, Total sugar, reducing sugar, non reducing sugar

Mango (*Mangifera indica* L.) is one of the most important members of the family Anacardiaceae under the order Sapindales. Ripe mango fruit pulp contains as much vitamin A as butter. Besides its exemplary nutritive value, it has luscious taste, captitive flavour, attractive fragrance and beautiful colour. Mango fruits take 6-10 days to ripe under ambient temperature and become over-ripe and spoiled within 15 days. A series of biochemical changes such as degradation of chlorophyll, biosynthesis of carotenoids, anthocyanins, essential oils and flavour components increase the activity of cell wall degrading enzymes. It is initiated by the autocatalytic production of ethylene which increases rate of respiration causing physiological, biochemical and organoleptic changes ultimately resulting into characteristic colour, taste, aroma with desirable softening (12). In the harvesting season, there is a glut of fruits in the market so it becomes imperative to prolong the shelf life of the fruits in the best interest of farmers' community and consumers as well. There are different methods of extending shelf life viz., pre-cooling, cold storage, controlled atmosphere storage and wax coating. In all these methods, the shelf life is extended by reducing the respiration rate and moisture loss from the fruits. In places, where refrigeration and storage facilities are not available, protective coating is one of the methods for increasing storage life of fresh fruits. Presence of sugar is the main quality of fruits. This can be retained at ripening stage for longer period by this affordable method. Paraffin coating retards the rate of increase of respiration which degrades the sugar of fruits after ripening. The decline in total sugar after its peak level might be due to breakdown of sugar during respiration process and fermentation during prolonged storage. Hence the present experiment has been conducted to observe the effect on sugar contents by paraffin liquid coatings of mango fruits in terms of shelf life and retention of sugar contents for longer periods.

MATERIALS AND METHODS

Fruit materials and their preparation for experiments

The matured fruits were harvested on 24th June of 2009 and 2010 from 34 year old Dashehari mango trees located at Horticulture Research Centre, Patharchatta. The trees were of uniform in growth and vigour and maintained under uniform cultural practices.

The fruits free from diseases and uniform in shape, size and colour were harvested in the morning time. Harvesting was performed with secateurs with more than 6 cm of fruit stalk Thereafter, fruits were washed thoroughly with running water to remove field heat, sap, adhering dirt particles and microflora and then shifted to laboratory. They were spread on blotting paper sheets and allowed to dry under fan in well ventilated and clean room. After uniform drying, fruits were graded again. The fruits of uniform size and maturity, free from pests and diseases, injuries, bruises and blemishes were selected and grouped according to treatments and replications. Treatments were as $T_{1:}$ 5 cm fruit stalk coated with paraffin liquid, $T_{2:}$ 5 cm fruit stalk uncoated, $T_{3:}$ 2 cm fruit stalk coated with paraffin liquid, $T_{4:}$ 2 cm fruit stalk uncoated, $T_{5:}$ 0.5 cm fruit stalk coated with paraffin liquid, $T_{6:}$ 0.5 cm fruit stalk uncoated, $T_{7:}$ 0 cm fruit stalk coated with paraffin liquid only on stalk point, $T_{8:}$ Whole fruit without stalk coated with 8% paraffin liquid and $T_{9:}$ Without fruit stalk uncoated (control).

Wax and Wax coatings

Colourless and light Paraffin liquid made of LOBA Chemie PVT. LTD. Mumbai 400 005, India; was used for the purpose. The fruit stalks and fruits were coated as mentioned in treatment details. Fruit stalks were cut with sharp blades as per treatment and replication and wax coating was done simultaneously. 8% paraffin liquid solution (v/v) was made at 37.7 ^{0}C in water bath and was stirred frequently till its application. It was coated on whole fruit without stalk with the help of cotton swab. Thus, 27 lots as per treatments (9) and replication (3) were prepared having 20 fruits in each. All the lots of fruits were kept in well ventilated (2%) CFB Box lined by daily news papers.

Mango fruits of both the experiments were stored in a clean, hygienic and well-ventilated room at ambient condition (temperature 31±1 ^{0}C and humidity 60±5%) in different lots consisting of 20 fruits per treatment per replication.

Methods of evaluation-

Shelf life

Shelf life was observed on the basis of overall retention of desired physical and chemical characteristics during storage period in days.

Sugars

Reducing and Total sugars were estimated as described (10). The procedure adopted is described as under- 25 ml of sample sugar dilution was taken in a 100 ml volumetric flask and 5 ml of HCl (1+1) were added. This was kept for 24 hours at the ambient temperature for the hydrolysis of non – reducing sugars to the reducing ones. Thereafter the content was neutralized with 1 N NaOH and made upto 100 ml of distilled water. It was titrated against freshly prepared and standardized Fehling's reagent as mentioned above.

The reducing sugar content was calculated by using following formula –

$$\text{Reducing sugar (\%)} = \frac{\text{Dilution} \times \text{Fehling's factor}}{\text{Titre} \times \text{Volume of sample}} \times 100$$

After calculating Total and Reducing sugars, non reducing sugars was obtained by using this formula-

$$\text{Non – reducing sugars (\%)} = (\text{Total sugars} - \text{Reducing sugars}) \times 0.95$$

Statistical analysis

The experimental data were subjected to analysis of variance (ANOVA) of simple and 2 factors Completely Randomized Design. The overall significance of differences among the treatments was tested by using critical difference (C.D.) at 5% level of significance.

Table 1 : Effect of different treatments on shelf life of mango cv. Dashehari

Treatment	Shelf life (days)		
	2009	2010	Pooled
T_1	11	12	11
T_2	9	11	10
T_3	10	10	10
T_4	9	9	9
T_5	9	10	9
T_6	8	8	8
T_7	8	8	8
T_8	13	13	13
T_9	7	7	7
CD at 5%	0.64	0.85	0.79

* Shelf life values are roundup

Table 2 : Effect of Paraffin liquid and storage periods on total sugar content (per cent) of Mango fruits Cv. Dashehari (year 2009 and 2010 and pooled over two years)

Treatment	Total sugar content (%)																				
	2009							2010							Pooled						
	0th day	3rd day	6th day	9th day	12th day	14th day	Mean	0th day	3rd day	6th day	9th day	12th day	14th day	Mean	0th day	3rd day	6th day	9th day	12th day	14th day	Mean
T_1	7.07	8.92	13.60	18.46	17.58	15.80	13.57	7.08	8.95	13.62	18.50	18.26	15.83	13.71	7.08	8.93	13.61	18.48	18.26	15.81	13.69
T_2	7.13	8.90	13.50	17.20	16.40	15.00	13.02	7.15	8.92	13.51	17.22	16.41	15.02	13.04	7.14	8.91	13.51	17.21	16.41	15.01	13.03
T_3	7.10	9.00	13.50	17.00	16.20	14.80	12.93	7.12	9.01	13.52	17.03	16.22	14.81	12.95	7.11	9.00	13.51	17.02	16.21	14.81	12.94
T_4	7.10	9.30	13.20	16.66	15.87	14.25	12.73	7.12	9.32	13.23	16.68	15.88	14.27	12.75	7.11	9.31	13.22	16.67	15.88	14.26	12.74
T_5	7.08	9.20	13.10	16.50	15.80	14.20	12.65	7.10	9.23	13.12	16.51	15.82	14.24	12.67	7.09	9.22	13.11	16.51	15.81	14.22	12.66
T_6	7.10	9.60	12.90	16.20	15.70	14.00	12.58	7.12	9.62	12.93	16.22	15.73	14.02	12.60	7.11	9.61	12.91	16.21	15.72	14.01	12.59
T_7	7.10	10.10	14.70	14.70	13.71	11.82	12.02	7.12	10.14	14.72	14.73	13.73	11.85	12.05	7.11	10.12	14.71	14.72	13.72	11.84	12.03
T_8	7.07	8.80	13.70	17.30	18.52	16.50	13.65	7.09	8.82	13.71	17.32	18.55	16.51	13.67	7.08	8.81	13.71	17.31	18.54	16.51	13.66
T_9	7.10	10.30	14.80	14.50	13.60	11.20	11.92	7.12	10.30	14.82	14.54	13.62	11.24	11.94	7.11	10.30	14.81	14.52	13.61	11.22	11.93
Mean	7.09	9.35	13.67	16.50	15.93	14.17		7.11	9.37	13.69	16.53	16.02	14.20		7.10	9.36	13.68	16.51	16.01	14.19	
		Day (A)		Treatment (B)		A × B			Day (A)		Treatment (B)		A × B			Day (A)		Treatment (B)		A × B	
CD at 5%		0.39		0.48		1.17			0.389		0.477		1.169			0.389		0.477		1.168	

T_1: 5 cm fruit stalk coated with paraffin liquid, T_2: 5 cm fruit stalk uncoated, T_3: 2 cm fruit stalk coated with paraffin liquid, T_4: 2 cm fruit stalk uncoated, T_5: 0.5 cm fruit stalk coated with paraffin liquid, T_6: 0.5 cm fruit stalk uncoated, T_7: 0 cm fruit stalk coated with paraffin liquid only on stalk point, T_8: Whole fruit without stalk coated with 8 % paraffin liquid, T_9: Without fruit stalk uncoated (control)

Table 3 : Effect of Paraffin liquid and storage periods on reducing sugar content (per cent) of Mango fruits Cv. Dashehari (year 2009 and 2010 and pooled over two years)

Treatment	Reducing sugar content (%)																				
	2009							2010							Pooled						
	0th day	3rd day	6th day	9th day	12th day	14th day	Mean	0th day	3rd day	6th day	9th day	12th day	14th day	Mean	0th day	3rd day	6th day	9th day	12th day	14th day	Mean
T_1	2.17	3.17	5.25	7.55	7.15	6.42	5.29	2.19	3.72	5.29	7.57	7.19	6.44	5.40	2.18	3.71	5.27	7.56	7.17	6.43	5.38
T_2	2.18	3.16	5.20	6.90	6.28	5.61	4.89	2.20	3.18	5.22	6.93	6.30	5.64	4.91	2.19	3.17	5.21	6.91	6.29	5.62	4.90
T_3	2.15	3.20	5.20	6.89	6.26	5.59	4.88	2.16	3.23	5.21	6.91	6.28	5.61	4.90	2.15	3.21	5.20	6.90	6.27	5.60	4.89
T_4	2.18	3.30	5.00	6.87	6.32	5.49	4.86	2.20	3.31	5.02	6.88	6.35	5.52	4.88	2.19	3.30	5.01	6.87	6.33	5.51	4.87
T_5	2.18	3.27	4.98	6.68	6.31	5.49	4.82	2.20	3.30	5.01	6.70	6.32	5.50	4.84	2.19	3.28	4.99	6.69	6.31	5.50	4.83
T_6	2.19	3.41	4.91	6.57	6.27	5.49	4.81	2.21	3.43	4.93	6.59	6.29	5.51	4.82	2.20	3.42	4.92	6.58	6.28	5.50	4.81
T_7	2.18	3.59	5.67	5.67	5.31	4.62	4.51	2.20	3.60	5.68	5.68	5.34	4.64	4.52	2.19	3.60	5.67	5.68	5.32	4.63	4.51
T_8	2.14	3.12	5.83	7.04	7.57	6.18	5.31	2.16	3.15	5.85	7.07	7.59	6.20	5.33	2.15	3.13	5.84	7.05	7.58	6.19	5.32
T_9	2.18	3.65	5.85	5.75	5.60	4.30	4.56	2.20	3.67	5.88	5.77	5.61	4.31	4.57	2.19	3.66	5.86	5.76	5.60	4.30	4.56
Mean	2.17	3.32	5.32	6.66	6.34	5.47		2.19	3.40	5.34	6.67	6.36	5.48		2.18	3.39	5.33	6.67	6.35	5.47	
	Day (A)		Treatment (B)			A × B		Day (A)		Treatment (B)			A × B		Day (A)		Treatment (B)			A × B	
CD at 5%	0.156		0.192			0.470		0.165		0.202			0.496		0.160		0.197			0.482	

T_1: 5 cm fruit stalk coated with paraffin liquid, T_2: 5 cm fruit stalk uncoated, T_3: 2 cm fruit stalk coated with paraffin liquid, T_4: 2 cm fruit stalk uncoated, T_5: 0.5 cm fruit stalk coated with paraffin liquid, T_6: 0.5 cm fruit stalk uncoated, T_7: 0 cm fruit stalk coated with paraffin liquid only on stalk point, T_8: Whole fruit without stalk coated with 8 % paraffin liquid, T_9: Without fruit stalk uncoated (control)

Table 4: Effect of Paraffin liquid and storage periods on Non-reducing sugar content (per cent) of Mango fruits Cv. Dashehari (year 2009 and 2010 and pooled over two years)

Treatment	Non-reducing sugar content (%)																				
	2009							2010							Pooled						
	0th day	3rd day	6th day	9th day	12th day	14th day	Mean	0th day	3rd day	6th day	9th day	12th day	14th day	Mean	0th day	3rd day	6th day	9th day	12th day	14th day	Mean
T_1	4.62	4.96	7.93	10.36	9.91	8.91	7.78	4.65	4.97	7.92	10.39	10.52	8.92	7.90	4.64	4.96	7.92	10.37	10.22	8.92	7.84
T_2	4.67	5.45	7.89	9.79	9.61	8.92	7.72	4.71	5.46	7.88	9.78	9.61	8.91	7.72	4.69	5.45	7.88	9.78	9.61	8.92	7.72
T_3	4.61	5.51	7.89	9.60	9.44	8.75	7.63	4.71	5.49	7.89	9.62	9.45	8.74	7.65	4.66	5.50	7.89	9.61	9.44	8.75	7.64
T_4	4.67	5.70	7.79	9.30	9.07	8.32	7.48	4.68	5.71	7.81	9.31	9.06	8.31	7.48	4.68	5.70	7.80	9.31	9.06	8.32	7.48
T_5	4.57	5.63	7.71	9.33	9.02	8.27	7.42	4.66	5.64	7.70	9.32	9.03	8.30	7.44	4.62	5.64	7.71	9.33	9.02	8.29	7.43
T_6	4.67	5.88	7.59	9.15	8.96	8.08	7.39	4.66	5.88	7.60	9.15	8.97	8.09	7.39	4.67	5.88	7.60	9.15	8.97	8.09	7.39
T_7	4.67	6.18	8.58	8.58	7.98	6.84	7.14	4.68	6.21	8.59	8.60	7.97	6.85	7.15	4.68	6.20	8.58	8.59	7.98	6.84	7.14
T_8	4.64	5.40	7.48	9.75	10.40	9.80	7.91	4.69	5.39	7.47	9.74	10.42	9.80	7.92	4.67	5.39	7.47	9.74	10.41	9.80	7.91
T_9	4.67	6.32	8.50	8.31	7.60	6.56	6.99	4.68	6.31	8.49	8.33	7.61	6.58	7.00	4.68	6.31	8.50	8.32	7.60	6.57	7.00
Mean	4.65	5.67	7.93	9.35	9.11	8.27		4.68	5.67	7.93	9.36	9.18	8.28		4.66	5.67	7.93	9.36	9.15	8.28	
	Day (A)		Treatment (B)		A × B			Day (A)		Treatment (B)		A × B			Day (A)		Treatment (B)		A × B		
CD at 5%	0.191		0.234		0.574			0.300		0.367		0.900			0.216		0.264		0.648		

T_1: 5 cm fruit stalk coated with paraffin liquid, T_2: 5 cm fruit stalk uncoated, T_3: 2 cm fruit stalk coated with paraffin liquid, T_4: 2 cm fruit stalk uncoated, T_5: 0.5 cm fruit stalk coated with paraffin liquid, T_6: 0.5 cm fruit stalk uncoated, T_7: 0 cm fruit stalk coated with paraffin liquid only on stalk point, T_8: Whole fruit without stalk coated with 8 % paraffin liquid, T_9: Without fruit stalk uncoated (control)

RESULTS AND DISCUSSIONS

Shelf life

Results of 2009, 2010 and pooled analysis of both the years (Table 1) revealed that paraffin liquid showed significant effect on shelf life under all the treatments over control. The shelf life of fruits treated with paraffin liquid could be extended up to 13 days over 7 days of untreated ones (control). The longest shelf life (13 days) was observed with the treatment T_8 (Whole fruit without stalk coated with 8% paraffin liquid) followed by T_1 (11 days). The untreated fruits (control) had shortest (7 days) shelf life (Table 1). The probable reason might be because paraffin liquid coating added shine and glossiness to the fruit surface apart from reducing moisture loss, rate of respiration by partially blocking the stomatal pores and thus improved external appearance and overall acceptability (2) and it retarded ripening and water loss, and reduced decay (1,9) which extended shelf life.

Total sugar content

The highest significant mean value of total sugar content (13.69%) was observed under T_1 (5 cm fruit stalk coated with paraffin liquid) which was at par with T_8 (13.66). Minimum mean value of the total sugar content (11.93%) was found in control (T_9) which was statistically at par with T_7 (Table 2). Since paraffin coating retards the rate of increase of respiration which degrades the sugar of fruits. The above results are in conformity with the findings (6) mango cv. Lucknow Safeda.

The results of pooled data (Table 2) also revealed that under all treatments, total sugar content of fruits increased gradually up to 6th day and at reaching the peak value, treatments started to decline slowly during the storage period. The results of interaction showed, maximum total sugar content (18.54%) under treatment T_8 on 12th day which was statistically at par with treatment T_1 on 12th day. The peak values of total sugar content under T_7 and T_9 (control) were observed on 6th day. These findings are in accordance with results (11).

Accumulation of ethylene in greater amount, consequently rapid ripening and faster conversion of starch and polysaccharides into sugar might be probable cause of increase in total sugar content of fruits. The decline in total sugar after its peak level might be due to breakdown of sugar during respiration process and fermentation during prolonged storage. The findings (8) in mango also support the view that sugar initially increased and then decreased

Reducing sugar content

Treatment of paraffin liquid increased and retained the reducing sugar content of fruits during storage period. The highest significant mean value of reducing sugar content (5.38%) was observed under T_1 (5 cm fruit stalk coated with paraffin liquid) which was at par with T_8. Minimum mean value of the same (4.56%) was found under control (T_9) which was statistically at par with T_7 (Table 3). This might be because coating of paraffin liquid retards the rate of respiration and ultimately ripening of fruits due to which reducing sugar content would have been reduced.

Storage periods affected reducing sugar content significantly. Maximum reducing sugar content (6.67%) was found on 9th day and minimum (2.18%) was on 0th day i.e. the day of harvest. Almost in all fruits, there is increase in reducing sugar content as the fruits proceeds towards ripening and till then most of the starch is not converted into sugar (4).

Significant effect of interactions between treatments and storage periods showed that maximum reducing sugar content (7.58%) under T_8 was observed on 12th day which was statistically at par with T_1 on 12th day. The peak value of reducing sugars content of T_7 and T_9 (control) treatments were observed on 6th day. The thin coating of paraffin liquid would have reduced the respiration rate of fruit due to which the process of conversion of starch into reducing sugar would have become slow. By the time, complete conversion would have taken place showing the higher value of reducing sugar. The higher value of reducing sugar might be due to increased rate of starch degradation by amylase activity (7).

Non reducing sugar content

The results of pooled data of 2009 and 2010 indicated (Table 4) that the highest significant mean value of non reducing sugar content (7.91%) was under treatment T_8 (Whole fruit without stalk coated with 8% paraffin liquid) which was at par with T_1 and T_2. Minimum mean value of non reducing sugar (7.00%) was found under control (T_9) which was at par with T_7. Since paraffin liquid coating of whole fruit (T_8) creates modified atmosphere around fruits by making a thin protective layer so, the breakdown of starch into reducing sugar becomes slow. Furthermore, ultimately higher proportion of starch is converted into non reducing sugar due to this thin protective layer due to which value of non reducing sugar content with advancement of storage period becomes higher. In case of T_1 due to presence of 5cm coated fruit stalk, the exudation of cell sap is minimized resulting ultimately high amount of non reducing sugar content. The similar findings were reported (5) on mango cv. Neelum.

Storage periods affected non reducing sugar content significantly (Table 4). Maximum percent of non reducing sugar (9.36%) was found on 9th day which was statistically at par with the value of 12th day. The minimum percentage of non reducing sugar (4.66%) was on 0th day (the day of harvest). The gradual increase in non reducing sugar content till attaining the peak value and then decreasing trend with increasing storage period was observed. The increase in the non-reducing sugar might be due to the hydrolysis of starch and conversion of the pectin substances from water insoluble to water soluble fractions. These results are in accordance with the findings (3 and 7) in guava.

CONCLUSIONS

Physiological, chemical and microbiological changes are rapid in mangoes. Post-harvest paraffin liquid coating brings synergistic effect in shelf life improvement of mangoes. There was significant difference among treatments in their effect on total sugar, reducing sugar and non-reducing sugar during storage. Higher values of total sugar, reducing sugar and non-reducing sugar were found 18.54%, 7.58% and 10.41% respectively on 12th day of storage under treatment Whole fruit without stalk coated with 8% paraffin liquid.

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GENETIC VARIABILITY AND CORRELATION STUDIES IN *GLADIOLUS HYBRIDA* L. UNDER TARAI CONDITION

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ABSTRACT

Twenty nine genotypes of gladiolus were evaluated for fifteen different characters to ascertain the genetic variability and association among the characters during 2010-11 at G.B. Pant University of Agriculture and Technology, Pantnagar. The phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) for all the fifteen characters studied. The higher PCV and GCV estimates were found for number of daughter corm/mother corm and cormel production. High heritability with high genetic advance was observed for plant height, days to first floret show colour, weight of corm and cormel production. The correlation studies revealed that plant height exhibited highly significant and positive correlation with weight of corm, corm diameter, rachis length and number of leaf per plant. There exists a significant and positive relationship of number of leaf per plant with weight of corm, corm diameter and rachis length; spikes length with number of leaves per plant. Floret diameter also exhibited significant and positive correlation with marketable spike per corm and number of daughter corm per mother corm. However, non-significant and positive correlation was found in characters *viz.*, plant height with durability of spike, marketable spike per corm and number of spike per corm; days to first floret show colour with spike length, rachis length and number of floret per spike; number of leaf per plant with cormel production; durability of spike with rachis length and corm diameter.

Key words: Genetic variability, correlation, gladiolus, corm, cut flower.

Gladiolus (*Gladiolus hybrida* L.) is a bulbous plant, belongs to family Iridaceae. It is one of the leading cut-flower crops grown in our countries, known for its majestic spikes which contain attractive, elegant and delicate florets. A huge quantum of variability exists in this crop with respect to shape, growth habit, flowering behaviour, vase life, etc. Inspite of such variability, very few are having desirable characters in terms of yield and quality. Knowledge of correlation studies helps the plant breeder to ascertain the real components of yield and provide an effective basis of selection. The characters contributing significantly to desirable traits can be significantly identified, and can be used as alternate selection criteria in crop improvement programmes. There are many varieties existing in gladiolus and every year there is an addition of new varieties. Therefore, to provide basic preliminary information to the plant breeders this correlation studies among important quantitative characters in gladiolus was undertaken.

MATERIALS AND METHODS

The present investigation was carried out at Model Floriculture Centre, Department of Horticulture, G. B. P. U. A. & T., Pantnagar in a randomized block design (RBD) with three replications. The experimental material for the present investigation was consisted of twenty nine genotypes of gladiolus. The investigation was conducted in open field at a spacing of 30 x 30 cm. All recommended agronomic package and practices were followed to grow a successful crop. Observations were recorded on five selected plants from each genotype in each replication. Observations were recorded for date of sprouting (days), plant height (cm), number of leaves/plant, days to first floret show colour (days), number of floret/spike, floret diameter (cm), spike length (cm), durability of spike (days), rachis length (cm), weight of corm (g) corm diameter (cm), number of daughter corm/mother corm, cormel production (g),total spike/corm and marketable spike/corm. Data were put to statistical analysis (11). Genetic parameters like genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were estimated (2) and heritability as suggested (17). Correlation analysis was carried out as per the formulae (4). The significance of phenotypic and genotypic correlation coefficients was tested against 'r' value given in (4) at (n-2) degree of freedom.

RESULTS AND DISCUSSION

The phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) (Table 1) was highest for cormel production followed by number of daughter corm/mother corm, total spike/corm and marketable spike/corm, suggesting that these characters are under genetic control. Hence, these characters can be relied upon selection for further improvement. The phonotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) for all the characters under study, indicating the role of environment in expression of genotype. Similar results were also reported by (9) in dahlia and (14) in *heliconia.* Minimum values of phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) were recorded for characters like days to first floret show colour, plant height and rachis length. This type of findings indicated that very minimum variation existed among the genotypes with respect to these characters. Narrow difference between phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) values were estimated for all the characters except floret diameter. Improvement of these characters is required, as the improved genotypes would not be affected by environmental expressivity. Similar trend also reported (1) in gladiolus for number of leaves and spike length. High heritability coupled with high genetic advance was observed for weight of the corm, spike length, plant height, days to first floret show colour and cormel production (Table 1). This indicates the lesser influence of environment in expression of these characters and prevalence of additive gene action in their inheritance hence, suitable for selection. Similar results were also noticed (8) in gladiolus. High heritability with moderate genetic advance was recorded for date of sprouting and durability of spike. These results are in accordance with the findings (5) in gladiolus. High heritability coupled with low genetic advance was recorded for number of leaves/plant and total number of spike/corm. This indicates that number of leaves/plant and total number of spike/corm to be under the control of non-additive genes and selection of these characters for improvement will be lesser effective. The genotypic and phenotypic correlation coefficients were computed in all possible combinations for fifteen characters and are presented in Tables 2 and 3. Correlation coefficient analysis measures the mutual relationship between various plant characters and determines the component characters on which selection is based for genetic improvement for a particular character (13). A positive correlation between desirable characters is favourable to the plant breeder because it helps in simultaneous improvement of both the characters. In the present study, genotypic correlation coefficients were found to be higher than phenotypic correlation coefficients for most of the characters, indicating a strong inherent association between various characters and were masked by environmental component with regard to phenotypic expression. Similar results were obtained (15) in gladiolus and (12) in marigold. The study showed a highly significant and positive correlation of plant height with weight of corm, corm diameter, rachis length, and number of leaf per plant(5). also reported significant and positive association of plant height with spike length in gladiolus. However, it exhibited significant and positive correlation with number of florets per spike. The results are in line with the findings (7) in gladiolus. But it had a highly significant and negative association with floret diameter at both genotypic and phenotypic levels. Non-significant and positive correlation was found in plant height with durability of spike, marketable spike per corm and total spike per corm.Number of leaf per plant exhibited positive and highly significant association with marketable spike per corm, total spike per corm, days to first floret show colour and number of floret per spike. Similar findings were also reported (10) in gerbera. However, it exhibited significant and positive correlation with corm diameter, weight of corm and spike length. But the number of leaf per plant has significant and negative correlation with floret diameter. There exists a positive and highly significant relationship of number of floret per spike with rachis length, weight of corm, corm diameter and spike length. However, it had a positive and significant relationship with number of spike per corm. But it showed negative and significant relationship with floret diameter.

The number of florets per spike showed positive and highly significant association with rachis length, weight of corm, corm diameter and spike length. Its association with total spike per corm was found to be positive and significant. Whereas, it was negative and significant with floret diameter. Positive and significant association was observed for floret diameter with marketable spike per corm and number of daughter corm per mother corm. However, it was highly significant and negative with rachis length. Spike length exhibited positive and highly significant association with rachis length and marketable spike per corm at both phenotypic and genotypic level. There exists a positive and highly significant relationship of rachis length with marketable spike per corm, weight of corm and corm diameter. The character has a positive and significant association with number of daughter corm per mother corm and total spike per corm at both genotypic and phenotypic levels. Positive and highly significant association was observed for weight of corm with corm diameter. However, its association was found to be significant and positive with marketable spike per corm. Number of daughter corm per mother corm exhibited positive and highly significant relationship with total spike per corm and cormel production. However, it had positive and significant association with marketable spike per corm. There exists a highly significant and positive correlation for total spike per corm with marketable spike per corm. The results are in conformity with the findings (15) in gladiolus; (16) dahlia and (6) china aster.

Table 1: Genetic parameters of different character in gladiolus

Sl. No.	Character	Range		Mean	Mean coefficient of variation		Heritability (%)	Genetic advance
		Min.	Max.		PCV (%)	GCV (%)		
1.	Date of sprouting	9.11	13.04	10.33	19.90	18.73	92.43	11.63
2.	Plant height	77.20	110.13	96.16	12.22	11.30	96.56	38.71
3.	Number of leaves/plant	7.00	10.23	8.68	20.67	6.13	88.19	6.58
4.	Days to first floret show colour	75.43	114.47	97.60	10.74	10.31	96.12	33.89
5.	Number of floret/spike	8.67	16.00	12.62	19.86	18.61	91.74	20.50
6.	Floret diameter	7.63	13.17	9.89	87.50	6.17	89.70	21.31
7.	Spike length	73.00	125.00	93.08	15.57	15.08	97.77	58.00
8.	Durability of spike	5.00	13.00	9.40	25.37	24.01	92.24	18.60
9.	Rachis length	32.22	44.67	39.95	12.31	11.89	74.50	10.50
10.	Weight of corm	28.33	64.67	49.99	24.95	23.59	98.42	50.97
11.	Corm diameter	3.97	6.70	5.55	13.33	11.97	80.52	22.23
12.	Number of daughter corm/mother corm	1.37	2.97	1.80	34.36	33.01	84.92	11.18
13.	Cormel production	3.40	20.00	8.97	53.84	48.81	94.19	33.53
14.	Total spike/corm	0.86	1.90	1.39	30.77	29.11	75.50	8.12
15.	Marketable spike/corm	0.56	1.66	0.99	30.94	29.15	86.09	22.21

Table 2: Genotypic correlation coefficient among the fifteen characters of gladiolus

Trait	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV
I	1	-0.65**	0.67	0.305	0.088	-0.337	0.220	0.361	0.039	-0.483*	-0.289	-0.656**	0.209	-0.352	0.152
II		1	0.56**	-0.271	0.447*	-0.594**	0.417*	0.247	0.575**	0.748**	0.635**	-0.092	-0.167	0.170	0.183
III			1	0.836**	0.786**	-0.532**	0.418*	0.591**	0.054	0.447*	0.453*	0.159	0.120	0.915**	0.923**
IV				1	0.157	-0.649**	0.272	-0.533**	0.235	0.017	-0.224	-0.401*	0.031	0.142	0.131
V					1	-0.457*	0.498**	0.123	0.606**	0.501**	0.501**	-0.106	-0.110	0.414*	0.356
VI						1	-0.313	-0.585	-0.640**	-0.060	0.375	0.512*	0.010	0.030	0.586*
VII							1	0.188	0.626**	0.276	0.359	-0.372	0.011	0.247	0.858**
VIII								1	0.373	0.152	0.286	0.131	0.262	0.054	0.252
IX									1	0.493**	0.489**	0.448*	0.223	0.445*	0.690**
X										1	0.794**	0.082	-0.223	0.142	0.379*
XI											1	0.169	-0.115	-0.252	0.294
XII												1	0.469**	0.612**	0.351*
XIII													1	0.289	0.244
XIV														1	0.937**
XV															1

I: Date of sprouting, II: Plant height, III: Number of leaves/plant, IV: Days to first floret show colour, V: Number of floret/spike, VI: Floret diameter, VII: Spike length, VIII: Durability of spike, IX: Rachis length, X: Weight of corm XI: Corm diameter XII: Number of daughter corm/mother corm, XIII: Cormel production XIV: Total spike/corm XV: Marketable spike/corm

*significant, **highly significant

Table 3: Phenotypic correlation coefficient among the fifteen characters of gladiolus

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV
I	1	-0.121	0.038	0.115	0.012	-0.050	0.087	0.087	0.097	-0.132	-0.082	-0.083	-0.010	0.025	0.085
II		1	0.126	-0.233	0.352	-0.023	0.382	0.164	0.256	0.643**	0.499	-0.021	-0.148	0.080	0.194
III			1	0.247	0.179	-0.043	0.421	-0.014	0.252	0.183	0.337	-0.238	0.856	-0.041	0.185
IV				1	0.121	-0.165	0.264	-0.433*	0.181	0.011	-0.176	-0.216	0.032	0.065	0.121
V					1	-0.187	0.731	0.058	0.425*	0.351*	0.329*	0.042	-0.575**	0.156	0.180
VI						1	-0.021	-0.068	-0.181	-0.128	-0.046	0.075	-0.050	-0.039	-0.020
VII							1	0.129	0.515**	0.252	0.342	-0.214	-0.013	0.075	0.279
VIII								1	0.219	0.094	0.226	0.192	0.158	-0.185	0.222
IX									1	0.353	0.301	0.071	0.133	0.083	0.449**
X										1	0.707	-0.011	-0.169	0.045	0.246
XI											1	0.122	-0.109	-0.004	0.191
XII												1	0.185	0.165	0.270
XIII													1	0.137	0.153
XIV														1	0.206
XV															1

I: Date of sprouting, II: Plant height, III: Number of leaves/plant, IV: Days to first floret show colour, V: Number of floret/spike, VI: Floret diameter, VII: Spike length, VI Durability of spike, IX: Rachis length, X: Weight of corm XI: Corm diameter XII: Number of daughter corm/mother corm, XIII: Cormel production XIV: Total spike/co XV: Marketable spike/corm

*significant, **highly significant

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EFFECT OF BIOFERTILIZER ON NODULATION OF PEA (*PISUM SATIVUM* L.) IN ALLUVIAL SOIL

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ABSTRACT

An explorative trial was conducted during rabi season of 2000-01, 2001-02 and 2002-2003 in the institute's research farm to study the effect of biofertilizers on nodulation properties of popular genotypes of garden pea (Pisum sativum L.). The experiment was conducted in a factorial design with Azospirillum, Azotobacter, Rhizobium and phosphate solubilizing microorganism (PSM) in Arkel, Azad P1 and Azad P3 genotypes of pea. The nodule number, nodule weight per plant, leghaemoglobin content and nitrogenase activity were increased linearly from active growth stage to peak at flowering and then declined towards maturity irrespective of genotypic variation and or microbial association in the rhizoplane of pea crop. The nitrogenase activity and leghaemoglobin contents were highly correlated (r=0.93) irrespective of varieties or treatments. The N fixation was highly correlated to the contents of leghaemoglobin (r=0.69) and nitrogenase activity (r=0.73) in pea. The higher leghaemoglobin content and nitrogenase activity was indicative of the preference of Azad P1 to Rhizobium, Azad P3 to Azotobacter and Arkel to PSM for symbiotic N fixation.

Key words: Pea, Biofertilizers, Nitrogenase, Leghaemoglobin, PSM

The cultivation of vegetable pea [*Pisum sativum* L. *Sub. sp. hortense Asoh. Graebn*] is gaining momentum over the last decades in Varanasi region especially replacing the conventional wheat crop. The farmers of this region were not acquainted with the uses of biofertilizers particularly *Azotobacter, Azospirillum* and phosphate solubilizing microorganism (PSM), together with *Rhizobium.* The scientific information on nodulation properties of pea as affected by *Azotobacter, Azospirillum* and P solubilizers are also limited. The present experiment was focused on the effect of biofertilizers on the nodulation and nitrogen fixation properties in widely grown pea varieties of eastern Uttar Pradesh.

MATERIALS AND METHODS

The present experiment was conducted for three years in a typic Ustochrept soil (82.52^0 longitudes and 25.10^0 N latitude) of Varanasi, with three popular varieties of vegetable pea (Azad P1, Azad P3 and Arkel) and four biofertilizers [*Rhizobium, Azotobacter, Azospirillum and phosphate solubilizing microorganism* (PSM)] along with control (no applied biofertilizers). The N- fixing biofertilizers were procured afresh from the Microbiology Division of IARI, New Delhi and PSM from KRIBHCO, Varanasi while the seeds of vegetable pea from certified seed pool of National Seed Project under IIVR, Varanasi. The live population count of the organism was made for taking care of quality and dose to provide functional and effective biofertilizer treatments. The soil of the experimental site was sandy loam, typic ustochrept. Important properties of the soil are: pH (1:2.5)-7.8, E.C at 25^0C -0.45 (dSm^{-1}), C.E.C -7.9 cmol (P^+) kg^{-1}, A.E.C -1.1 cmol (e^-) kg^{-1}, organic C -0.47%, clay-13.5%, silt-35.5%, sand-49.0%, free $CaCO_3$ -1.5%, Ca^{+2}+Mg^{+2} - 4.6 cmol (p^+) kg^{-1}, percent base saturation-69.5, available nitrogen -218 kg ha^{-1}, available potash-371 kg ha^{-1}, available phosphorus 12 kg ha^{-1}, water holding capacity - 20.8%, non occluded Al- and Fe-bound P-57.9 mg kg^{-1}, P occluded within Fe-oxides and hydrous oxides-10 mg kg^{-1}, Ca-bound P-315.8 mg kg^{-1}, Smectite-9%, Chlorite-18%, Illite-45%, Kaolinite-26%, Vermiculite-1%. The seeds of pea crops were treated @ 200-250g /10 kg with individual biofertilizers, sown in each plot at a spacing of 30 x 10 cm and then covered with soil. The recommended fertilizer doses (N @ 30 kg/ha, P @ 60 kg/ha and K @ 60 kg/ha) were applied during the field preparation through urea, diammonium phosphate and muriate of potash. The plants were uprooted at three specific crop growth stages for counting the nodules number, nodule weight, leghaemoglobin contents and nitrogenase activity. The data were taken at active growth stage (S1, at 28 days after sowing), 50 % flowering stage (S2, at 42 days after sowing) and pod filling stage (S3, at 49 days after sowing). The nodules were carefully detached from the roots and collected in an icebox form the experimental site. In laboratory, nodules were kept over filter paper for soaking of excess adhered moisture. The leghaemoglobin contents of nodule were estimated following the spectrophotometric method (1). Nitrogenase activity was measured by acetylene reduction assays (7).

RESULTS AND DISCUSSION

The nodule number and leghaemoglobin contents were significantly varied with the crop growth stage in all the three varieties (2) indicated that the nodule number and leghaemoglobin content were highly correlated at the early pod setting stage. In Azad P3, *Azotobacter* influenced significantly higher nodulation over other biofertilizers. The highest average nodule number (34.47) was recorded in Azad P3 at 50% flowering stages when inoculated with *Azotobacter*, which was 42.8 % more to the uninoculated pea (Figure1). Significantly higher root nodule number (31.21) at pod filling stage was recorded in Azad P1 when inoculated with *Azotobacter*. In Arkel variety the significantly higher nodule number (25.37) and leghaemoglobin contents was observed at 50 % flowering stage when inoculated by PSM. This was an indication of higher affinity for the phosphorus by the Arkel variety for the active nodulation on pea rhizoplane, which corroborates with the finding that plant growth and nodulation in pea increased by supplementary P (6). The leghaemoglobin content of the nodule has a significant positive impact on the nitrogenase activity, which ultimately plays an important role in nitrogen fixation (5). Scientific literature hypothesized that more the leghaemoglobin content, more would be the nitrogenase activity and more the N fixation (3). The highest leghaemoglobin (1.33) was recorded in Azad P3 at 50% flowering stage when inoculated with Azotobacter. *Azotobacter* application leads to an increased active nodulation, higher nitrogenase activity and nitrogen fixation. The nitrogenase activity was 18.79 % more when inoculated with *Azotobacter* as compared to the uninoculated pea which corroborates with the findings (4). In Azad P1 the leghaemoglobin content was 16.26 % higher when inoculated with the *Rhizobium* compared to the control. In Arkel the highest leghaemoglobin content was 0.99 mg/g nodules at 50 % flowering stage when inoculated with PSM that was 12.12 % higher than the control. The nodule number and the leghaemoglobin was maximum at 50 % flowering stage, which linearly increases from active growth stage to flowering stage and starts to decline from pod filling stage (Figure 1). In general nitrogenase activity was more in all three varieties when inoculated by *Azotobacter*. Nitrogenase activity was 2.5 and 3.4 times more in Azad P3 compared to Azad P 1 and Arkel when inoculated with *Azotobacter*. Inoculation of PSM in Arkel and *Rhizobium* in Azad p1 induced higher nitrogenase activity (Table 1). High degree of correlation between the nitrogenase activity and leghaemoglobin contents (r=0.93) was observed in the root nodules of pea irrespective of genotypic variation and association of biofertilizers in the rhizoplane.

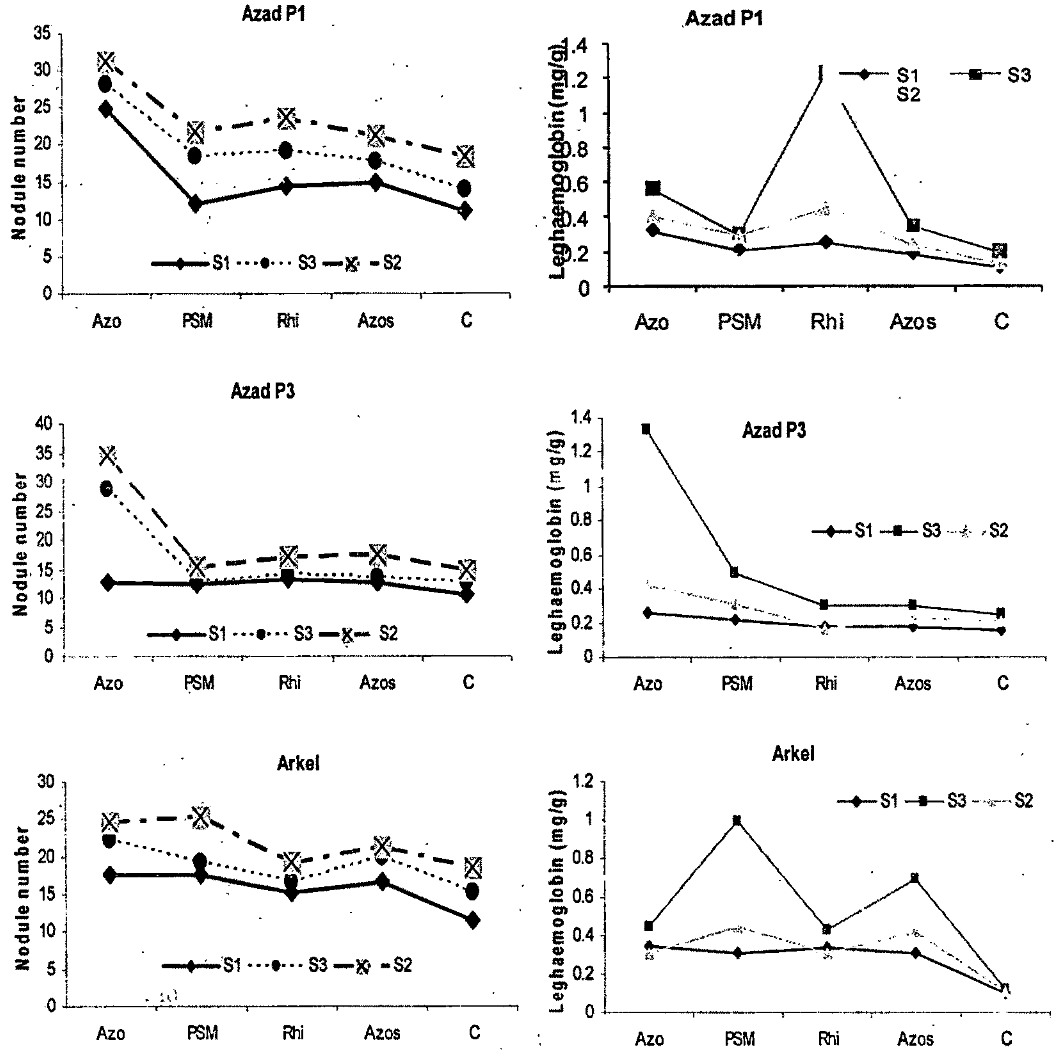

Figure 1. Effect of biofertilizers on nodule number and leghaemoglobin content (mg/g nodule) at active S1, 50 % flowering S2 and pod filling S3 stages

Table 1. Effect of biofertilizers on leghaemoglobin content (mg/g nodule) and nitrogenase activity (μ moles C_2H_4/plant/h) of pea at flowering stage (42 days after sowing)

Treatments	Azad P-1		Azad P-3		Arkel	
	Leghaemoglobin of nodule	Nitrogenase activity	Leghaemoglobin of nodule	Nitrogenase activity	Leghaemoglobin of nodule	Nitrogenase activity
Azotobacter	0.56	5.34	1.33	13.45	0.45	3.97
PSM	0.30	2.92	0.49	3.95	0.99	7.69
Rhizobium	1.23	9.89	0.296	2.63	0.43	3.25
Azospirillum	0.35	3.78	0.3	2.53	0.69	4.63
Control	0.20	2.21	0.25	1.98	0.12	1.02
LSD $_{0.05}$	0.037	0.029	0.09	0.32	0.07	0.41

The maximum number of nodule, leghaemoglobin content and nitrogenase activity was recorded in the variety inoculated with *Azospirillum* in Azad P3. The similar correlation of nodule number was also reported (5) in *Vigna mungo* crop. The present finding indicated that more the leghaemoglobin content, more the nitrogenase activity (Table 1). The nitrogenase activity in the root nodules of pea was calculated only at the 50 % flowering stage as the maximum leghaemoglobin contents was observed at this stage. The nutrient status of the experimental soil sample was analyzed before the sowing and after the harvest of the crop. There was a positive change in the available N status of the experimental soil sample, due to the contribution of biofertilizers in the fixation of atmospheric nitrogen. An average positive balance of N ranged 25 to 46 kg ha^{-1}, zero balancing of S, marginal positive balance (0.2 to 3.5 kg ha^{-1}) in phosphorus and potassium (0.7 to 8.4 kg ha^{-1}) was recorded depending on varieties of garden pea crop. Significantly higher N fixations was observed in Azad P3, followed by Azad P1 and Arkel, which could be explained by the contents of leghaemoglobin and nitrogenase activity of the respective varieties.

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DETERMINATION OF VARIABILITY FOR YIELD ADVANCEMENT IN BOTTLE GOURD [*LAGENARIA SICERARIA* (MOLINA) STANDL]

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ABSTRACT

An experiment entitled "Determination of variability for yield advancement in Bottle gourd [*Lagenaria siceraria* (Molina) Standl]" was carried out at Horticulture Research Farm, Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, Lucknow during Kharif season of 2008 and 2009. The trial was conducted in Randomized Block Design with three replications. The observations were recorded on twelve characters of bottle gourd viz. days to fifty percent germination, days to first male flower anthesis, days to first female flower anthesis, node number to first male flower, node number to first female flower, vine length (m), number of nodes per vine, number of primary branches per plant, length of fruit (cm), weight per fruit (kg), number of fruits per plant and fruit yield per plant (Kg). The analyzed data revealed that among the 15 parents PSPL followed VRBG-88 and VRBG-105 gave maximum results and among the 36 F_1 hybrids, cross VRBG-44 x Pusa Naveen followed by VRBG-105 x Pusa Naveen and VRBG-44 x PSPL gave maximum fruit yield per plant.

Key words: Variability, yield & advancement

Bottle gourd [*Lagenaria siceraria* (Mol.) Standl.] belongs to the family cucurbitaceae having chromosome number 2n = 22. Bottle gourd is one of the most important cucurbits cultivated in India. It is grown in rainy season and as well as summer season vegetable. It is also known as white flowered gourd. The bottle gourd belongs to genus *Lagenaria* which derived from lagena meaning bottle. In the past, it is often referred to as *Lagenaria vulgaris* (common) or *Lagenaria leucantha* (White flowered), but it is now generally agreed that the correct name is *Lagenaria siceraria*. The word *siceraria* meaning drinking vassals. It seems that bottle gourd was originated from India because its wild races are still found in Deharadoon (high humid area) and Malabar costal area.

The genetic improvement of any crop depends upon the available genetic variability for quantitative traits and its judicious exploitation through efficient breeding methods. Selection plays an important role among various breeding approaches at one or other stages, as it acts on the available genetic variability to evolve superior genotypes. The nature and amount of genetic variability available in the germplasm indicates the scope of improvement in the character by exploiting the genetic variability depends mainly upon the extent of transmissibility of the character in question.

The genotypic and phenotypic coefficient of variation helps in expressing the nature of variability in the breeding population, whereas, the estimation of heritability provides index for transmissibility of characters. The genetic advancement fulfils more clear selection by taking into account the scope and effectiveness of selection for improving a character condition by genetic variability and transmissibility, respectively. The genotypic correlation provides information of genetic association between pairs of characters and it is generally used in selection for one character or for improving another. Such correlation coefficient provides information themselves.

MATERIALS AND METHODS

The present investigation entitled "Determination of variability for yield advancement in Bottle gourd [*Lagenaria siceraria* (Molina) Standl]" was carried out at Horticulture Research Farm, Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University, Lucknow during Kharif season of 2008 and 2009. Fifteen parental lines of bottle gourd including twelve lines and three testers namely AD-1, DK, PBOG-22, VRBG-1, VRBG-18, VRBG-40, VRBG-44, VRBG-88, VRBG105, VRBG-107, VRBG-112, VRBG-148, Pusa Naveen, PSPL and NDBG-104, respectively were used to made crosses in line x testers fashion design to produce 36 crosses. The parents and their crosses were grown with plant to plant 1.0 m and row to row 2.0 m during the trial period. The trial was conducted in Randomized Block Design with three replications. All the recommended agronomic package of practices were taken to grow a healthy crop. Five competitive plants were selected randomly in each replication for recording observations. The observations were recorded on 12 characters viz. days to fifty percent germination, days to first male flower anthesis, days to first female flower anthesis, node number to first male flower, node number to first female flower, vine length (m), number of nodes per vine, number of primary branches per plant, length of fruit (cm), weight per fruit (kg), number of fruits per plant and fruit yield per plant (Kg). The analysis of variance was done as suggested (4). Variability for different quantitative characters was estimated as suggested (1). Heritability and expected genetic advance was calculated according to (7) and (3), respectively.

RESULTS AND DISCUSSION

Analysis of variance for twelve characters of parents of bottle gourd is given (table-1). The variance of different characters was partitioned into replication, treatment and error. The mean sum of square due treatment was highly significant for all the characters under study.

The coefficient of variation, heritability and genetic advance value of parents for 12 characters are presented in table- 2. The phenotypic coefficient of variation (PCV) was higher than their respective genotypic coefficient of variation (GCV) for all the traits under study. Phenotypic coefficient of variation was higher for number of primary branches per plant (34.21%) followed by node number to first male flower (31.00%), fruit yield per plant (30.19%) and vine length (28.21%), whereas, it was moderate for weight per fruit (18.84%) followed by number of fruits per plant (17.01%), node number of first female flower (15.83%) and length of fruit (15.41%) and low was recorded for number of nodes per vine (9.57%) followed by days to fifty percent germination (9.55%) and days to first male flower anthesis (6.21%) and it was lowest recorded for days to first female flower anthesis (5.64%).Highest genotypic coefficient of variation was observed for number of primary branches per plant (33.75%) followed by node number to first male flower (30.61%), fruit yield per plant (30.03%) and vine length (27.70%) and it was moderate for number of fruits per plant (16.36%) followed by length of fruit (15.38%), node number to first female flower (15.37%) and weight per fruit (15.26%), while, it was showed low rate for number of nodes per vine (9.54%), followed by days to fifty percent germination (9.00%), days to first male flower anthesis (6.12%) and lowest was recorded for days to first female flower anthesis(5.53%). The highest genotypic and phenotypic coefficient of variation was recorded for number of primary branches per plant (33.75% and 34.21%) and lowest was recorded for days to first female flower anthesis (5.53% and 5.64%). Heritability value in broad sense is presented in table-2. The high value of broad sense heritability was recorded for all the characters except weight per fruit. The highest heritability was recorded for length of fruit (99.6%) followed by number of nodes per vine (99.4%), fruit yield per plant (98.3%), days to first male flower anthesis (97.2%), days to first female flower (96.4%), node number to first male flower (96.3%), number of primary branches per plant (96.2%), node number to first female flower (94.3%), vine length (93.4%), number of fruits per plant (92.5%) and days to fifty percent germination (88.8%), whereas, minimum was recorded for weight per fruit (65.7%). The genetic gain is presented in table-2. The highest genetic gain was recorded for node number to first male flower (53.38%) followed by fruit yield per plant (49.80%), number of fruits per plant (41.54%), node number to first female flower (39.43%), length of fruit (38.78%) and vine length (37.50%), but, it was low for number of nodes per vine (25.10%), days to fifty percent germination (22.35%), days to first female flower anthesis (15.95%), days to first female flower anthesis (14.35%), number of primary branches per plant (4.94%) and weight per fruit (1.93%).

The analyses of variance of 36 F_1 crosses for twelve characters are given in table-3. The variance of different characters was partitioned into replication, treatment and error. The mean sums of square due to treatment were highly significant for all the characters under study.

The coefficient of variation, heritability and genetic advance value of 36 F_1 crosses for 12 characters are presented in table-4. Phenotypic coefficient of variation was higher than their corresponding genotypic coefficient of variation for all the characters. Phenotypic coefficient of variation was highest for number of primary branches per plant (35.37%) followed by fruit yield per plant (32.55%), vine length (32.50%), node number to first female flower (26.86%), number of fruits per plant (25.73%), weight per fruit (23.36%) and node number to first male flower (19.91%), whereas, it was exhibited low value for length of fruit (15.89%), number of nodes per vine (14.09%), days to fifty percent germination (10.23%), days to first male flower anthesis (6.23%) and days to first female flower anthesis (6.15%). Highest genotypic coefficient of variation was observed for fruit yield per plant (31.75%) followed by number of primary branches per plant (28.75%), vine length (24.25%), node number to first female flower (22.17%), number of fruits per plant (21.09%), weight per fruit (19.90%), node number to first male flower (19.75%) and number of nodes per vine (13.07%) and it was low for days to fifty percent germination (10.01%), days to first male flower anthesis (6.20%) and days to first female flower anthesis (5.95%). The heritability value for twelve characters of bottle gourd is presented in table- 4. The high value of heritability was recorded for all the characters. The highest heritability was recorded for length of fruit (99.90%) followed by number of nodes per vine (99.4%), days to first female flower anthesis (99.12%), days to first male flower anthesis (99.04%), fruit yield per plant (98.92%), node number to first female flower (98.81%), node number to first male flower (98.43%), number of primary braches per plant (97.91%), vine length (96.52%), days to fifty percent germination (95.75%) and number of fruits per plant (92.48%) and minimum was recorded in weight per fruit (83.65%). The genetic gain for twelve characters of bottle gourd is also presented in table-4. The highest genetic gain was recorded for number of primary branches per plant (65.59%) followed by fruit yield per plant (54.48%), node number to first male flower (51.74%), length of fruit (41.37%), number of fruits per plant (40.85%), node number to first female flower (38.77%), weight per fruit (37.61%), vine length (36.96%) and days to fifty percent germination (25.86%), but, it was lowest for days to first male flower anthesis (16.29%) and days to first female flower anthesis (14.14%).

The genotypic and phenotypic correlation coefficient of parent for twelve characters of bottle gourd are presented in table-5. Yield is considered to be the most important trait, on the basis of yield potential of parents are included in breeding programme to developed inbred line /hybrids.

It was evident from table-5 that fruit yield per plant had positive and highly significant genotypic correlation coefficient with weight per fruit (0.767) followed by length of fruit (0.668), number of fruits per plant (0.596), number of nodes per vine (0.592), vine length (0.584), number of primary branches per plant (0.545) and days to first female flower anthesis (0.506). Number of fruits per plant had positive and significant correlation with number of primary branches per plant (0.882). Weight per fruit showed positive and significant correlation with number of primary branches per plant (0.785) and length of fruit (0.543). The number of primary branches per plant had positive and significant correlation with number of nodes per vine (0.707) and vine length (0.696). The number of nodes per vine had positive and significant correlation with vine length (0.781). The node number to first female flower had positive and significant correlation with node number to first male flower anthesis (0.893) and days to first female flower anthesis had positive and significant correlation with days to first male flower anthesis (0.931). However, negative and significant correlation were recorded for weight per fruit with days to fifty percent germination (-0.518). The length of fruit also showed negative and significant correlation with days to fifty percent germination (-0.615). Whereas, node number to first female flower and node number to first male flower showed negative and non significant correlation with days to fifty percent germination.

At the phenotypic level, it was observed that fruit yield per plant had positive and significant correlation with weight per fruit (0.605) followed by vine length (0.577), number of fruits per plant (0.568), length of fruit (0.565), number of primary branches per plant (0.525), days to first female flower anthesis (0.492) and number of nodes per vine (0.490). The number of fruits per plant had positive and significant correlation with number of primary branches per plant (0.674). The weight per fruit had positively and significantly correlated with number of primary branches per plant (0.642) and length of fruit (0.498). The number of primary branches per plant showed positive and significant correlation with number of nodes per vine (0.703) and vine length (0.693). The number of nodes per vine had positively and significantly correlated with vine length (0.767). The node number to first female flower had positive and significant correlation with node number to first male flower (0.884) and days to first female flower anthesis positively and significantly correlated with days to first male flower anthesis (0.921). However, negative and significant correlation were observed for length of fruit (-0.611) and weight per fruit (-0.507) with days to fifty percent germination. Whereas, negative and non significant correlation were recorded for node number to first female flower and node number to first male flower with days to fifty percent germination.

The path coefficient analysis was obtained for clear, understanding of association of the genotypic correlation coefficient of yield with contributing components. The genotypic correlation coefficient was partitioned into direct and indirect effects through path coefficient analysis of parents. The results of path coefficient for parent are presented in table-6. At genotypic level, highest positive direct effect towards yield per plant was showed by weight per fruit (0.868) followed by number of fruits per plant (0.710), number of nodes per vine (0.486), length of fruit (0.459), days to first female flower anthesis (0.316), node number to first female flower (0.243) and days to fifty percent germination (0.011), while, highest negative effect towards fruit yield per plant was showed by vine length(-0.716) followed by node number first male flower (-0.123), days to first male flower anthesis (-0.081) and number of primary braches per plant (-0.060).

From the estimate of correlation coefficient and direct and indirect effect of fruit yield attributing traits, it is clear that for bring out designed improvement towards fruit yield in future of bottle gourd weight per fruit and number of fruits per plant can be used as direct selection parameters.

The genotypic and phenotypic correlation coefficient of hybrids for twelve characters of bottle gourd are presented in table – 7. Yield is considered to be the most important character, on the basis yield ability of crosses are included in breeding programme to developed inbred line/hybrids. As table- 7 revealed that fruit yield per plant had positive and highly significant genotypic correlation coefficient with weight per fruit (0.747) followed by days to first female flower anthesis (0.741), number of fruits per plant (0.580), length of fruit (0.540), node number to first female flower (0.526) and number of primary branches per plant (0.515). The number of fruits per plant exhibited positive and highly significant genotypic correlation with number of primary branches per plant (0.712) followed by vine length (0.623). The weight per fruit had positive and significant correlation with length of fruit (0.549) followed by number of primary branches per plant (0.574), number of nodes per vine (0.523) and vine length (0.494). The length of fruit had positive and significant correlation with number of nodes per vine (0.461). The number of primary branches per plant showed positive and significant correlation with number of nodes per vine (0.790) followed by vine length (0.513). The number of nodes per vine had positive and significant correlation with vine length (0.792). The node number of first female flower showed positive and significant correlation with node number to first male flower (0.828). A very high positive and significant genotypic correlation was recorded between days to first female flower anthesis with days to first male flower anthesis (0.969).

However, negative and significant genotypic correlation were observed for days to first female flower anthesis with days to fifty percent germination (-0.513). On the other hand most of the characters had negative and non significant correlation with days to fifty percent germination followed by days to first male flower anthesis and days to first female flower anthesis.However, negative and non significant correlation were observed for most of the characters. Negative and non significant correlation were observed for days to fifty percent germination followed by days to first male flower anthesis and days to first female flower anthesis.

Table 1: Analysis of variance for the 15 parents of bottle gourd

S. No	Source of variation	D. F.	Characters											
			Days to fifty percent germination	Days to first male flower anthesis	Days to first female flower anthesis	Node number to first male flower	Node number to first female flower	Vine length (m)	Number of nodes per vine	Number of primary branches per plant	Length of fruit (cm)	Weight per fruit(kg)	Number of fruits per plant	Fruit yield per plant(kg)
1.	Replication	2	1.80	2.68	3.03	1.54	2.01	1.68	2.01	2.03	2.17	0.68	1.72	1.76
2.	Treatments	14	2.31**	20.30**	17.89**	6.14**	4.97**	2.60**	31.67**	4.19**	106.93**	3.07**	2.13**	10.34**
3.	Errors	28	0.93	0.19	0.22	0.178	0.098	0.060	0.68	0.054	0.140	0.045	0.056	0.060

***, ** Significant at 5% and 1% level, respectively.**

Table 2: Estimation of range, mean, genotypic coefficient of variance (GCV), phenotypic coefficient of variance (PCV), heritability, genetic advance and genetic gain of 15 parents for 12 characters of bottle gourd

S. No.	Characters	Range		Grand mean	GCV	PCV	Heritability	Genetic advance	Genetic gain
		Min.	Max.						
1	Days to fifty percent germination	8.86	12.22	10.54	9.00	9.55	88.8	2.14	22.39
2	Days to first male flower anthesis	37.50	47.89	42.69	6.12	6.21	97.2	6.74	15.95
3	Days to first female flower anthesis	38.75	47.70	43.72	5.53	5.64	96.4	6.29	14.35
4	Node number to first male flower	4.98	10.12	7.55	30.61	31.00	96.3	3.68	53.38
5	Node number to first female flower	7.05	12.05	9.55	15.37	15.83	94.3	3.27	39.43
6	Vine length (m)	4.77	6.88	5.82	27.70	28.21	93.4	2.35	37.50
7	Number of nodes per vine	22.75	38.50	30.62	9.54	9.57	99.4	8.54	25.10
8	Number of primary branches per plant	2.99	6.94	4.96	33.75	34.21	96.2	3.04	4.94
9	Length of fruit (cm)	22.03	42.83	32.43	15.38	15.41	99.6	15.72	38.78
10	Weight per fruit(kg)	1.25	2.39	1.82	15.26	18.84	65.7	0.63	1.93
11	Number of fruits per plant	2.96	6.30	4.63	16.36	17.01	92.5	2.11	41.54
12	Fruit yield per plant(kg)	3.99	10.75	7.37	30.03	30.19	98.3	4.84	49.80

Table 3: Genotypic (G) and Phenotypic (P) correlation coefficient for different pairs of characters in 15 parents of bottle gourd

Parents Line (Female)	Symbol	Days to first male flower anthesis	Days to first female flower anthesis	Node number to first male flower	Node number to first female, flower	Vine length (m)	Number of nodes per vine	Number of primary branches per plant	Length of fruit (cm)	Weight per fruit(kg)	Number of fruits per plant	Fruit yield per plant(kg)
Days to fifty percent germination	G	-0.181	-0.119	-0.381	-0.400	-0.284	-0.012	-0.119	-0.615**	-0.518**	-0.300	0.083
	P	-0.180	-0.110	-0.367	-0.389	-0.269	-0.012	-0.112	-0.611**	-0.507**	-0.278	0.078
Days to first male flower anthesis	G		0.931**	0.141	0.169	0.078	-00.27	0.273	0.079	0.251	-0.121	0.058
	P		0.921**	0.136	0.170	0.072	-00.27	0.268	0.078	0.231	-0.112	0.056
Days to first female flower anthesis	G			0.117	0.147	0.047	-00.48	0.271	0.060	0.194	-0.081	0.506**
	P			0.121	0.149	0.052	-00.48	0.272	0.061	0.173	-0.080	0.492**
Node number to first male flower	G				0.893**	0.307	0.167	0.246	0.101	0.328	-0.345	0.029
	P				0.884**	0.307	0.167	0.245	0.100	0.295	0.336	0.025
Node number to first female flower	G					0.202	0.051	0.194	0.184	0.427	0.420	0.042
	P					0.204	0.053	0.195	0.184	0.387	0.400	0.033
Vine length (m)	G						0.781**	0.696**	0.306	0.382	0.015	0.584**
	P						0.767**	0.693**	0.301	0.337	0.025	0.577*
Number of nodes per vine	G							0.707**	0.309	0.339	0.152	0.592**
	P							0.703**	0.308	0.307	0.148	0.490**
Number of primary branches per plant	G								0.107	0.785**	0.882**	0.545**
	P								0.107	0.642**	0.674**	0.525**
Length of fruit (cm)	G									0.543**	0.098	0.668**
	P									0.498**	0.094	0.565**
Weight per fruits(kg)	G										0.167	0.767**
	P										0.137	0.605**
Number of fruits per plant	G											0.596**
	P											0.568**

*,**Significant at 5% and 1% level, respectively.

Table 4: Genotypic path coefficient analysis (direct and indirect effect) of yield contributing characters in 15 parents of bottle gourd

Characters	Days to fifty percent germination	Days to first male flower anthesis	Days to first female flower anthesis	Node number to first male flower	Node number to first female flower	Vine length (m)	Number of nodes per vine	Number of primary branches per plant	Length of fruit (cm)	Weight per fruit (kg)	Number of fruits per plant	Fruit yield per plant(kg)
Days to fifty percent germination	**0.011**	0.021	0.014	0.014	0.047	0.033	0.001	0.014	0.013	0.025	0.035	0.083
Days to first male flower anthesis	0.014	**-0.081**	0.076	0.015	0.013	0.064	0.023	0.224	0.065	0.020	0.100	0.058
Days to first female flower anthesis	0.003	0.029	**0.316**	0.037	0.047	0.015	-0.015	0.086	0.019	0.062	0.026	0.506
Node number to first male flower	0.047	0.017	0.014	**-0.123**	0.110	0.038	0.027	0.030	0.012	0.045	0.042	0.029
Node number to first female flower	0.057	0.024	0.021	0.127	**0.243**	0.029	0.074	0.028	0.021	0.061	0.060	0.042
Vine length (m)	0.020	0.056	0.034	0.022	0.014	**-0.716**	0.056	-0.021	0.015	0.027	0.001	0.584
Number of nodes per vine	0.006	0.014	0.024	0.081	0.025	0.037	**0.486**	0.014	0.006	0.016	0.074	0.592
Number of primary branches per plant	0.007	0.016	0.016	0.015	0.012	0.018	0.018	**-0.060**	0.026	0.023	0.005	0.545
Length of fruit (cm)	0.053	0.036	0.028	0.046	0.085	0.014	0.014	0.049	**0.459**	0.025	0.045	0.668
Weight per fruit(kg)	0.189	0.218	0.169	0.285	0.371	0.331	0.294	0.334	0.472	**0.868**	0.145	0.767
Number of fruits per plant	0.213	0.086	0.058	0.245	0.298	0.011	0.108	0.058	0.700	0.119	**0.710**	0.596

Residual effect = 0.1363

Table 5: Analysis of variance for the 36 F_1 hybrids of bottle gourd

S. No	Source of variation	D. F.	Characters											
			Days to fifty percent germination	Days to first male flower anthesis	Days to first female flower anthesis	Node number to first male flower	Node number to first female flower	Vine length (m)	Number of nodes per vine	Number of primary branches per plant	Length of fruit (cm)	Weight per fruit(kg)	Number of fruits per plant	Fruit yield per plant(kg)
1.	Replication	2	1.146	2.213	1.844	1.331	1.111	1.535	1.918	1.388	1.739	0.481	1.821	1.522
2.	Treatments	35	1.937**	18.256**	15.705**	4.790**	4.457**	2.565**	22.324**	4.177**	111.747**	2.824**	1.968**	6.815**
3.	Errors	70	0.095	0.196	0.261	0.065	0.117	0.054	0.063	0.056	0.155	0.500	0.049	0.048

***, ** Significant at 5% and 1% level, respectively.**

Table 6: Estimation of range, mean, genotypic coefficient of variance (GCV), phenotypic coefficient variance (PCV), heritability, genetic advance and genetic gain for 36 F_1 hybrids for 12 characters of bottle gourd

S. No.	Characters	Range		Grand mean	GCV	PCV	Heritability	Genetic advance	Genetic gain
		Min.	Max.						
1	Days to fifty percent germination	7.80	11.26	9.53	10.01	10.23	95.75	2.60	25.86
2	Days to first male flower anthesis	35.51	47.28	41.89	6.20	6.23	99.04	6.95	16.29
3	Days to first female flower anthesis	37.21	47.72	42.46	22.38	27.40	99.12	6.27	14.14
4	Node number to first male flower	4.55	9.06	6.81	19.75	19.91	98.43	3.91	51.74
5	Node number to first female flower	6.17	11.25	8.71	22.17	26.86	98.81	3.59	38.77
6	Vine length (m)	4.99	8.48	6.73	24.25	32.50	96.52	2.13	36.96
7	Number of nodes per vine	23.83	39.95	31.89	13.07	14.09	99.75	10.74	34.47
8	Number of primary branches per plant	3.22	7.75	5.48	28.75	35.37	97.91	2.92	65.59
9	Length of fruit (cm)	25.17	48.10	36.63	15.68	15.89	99.90	15.43	41.37
10	Weight of fruit(kg)	1.29	2.65	1.97	19.90	23.36	83.65	6.64	37.61
11	Number of fruits per plant	4.24	7.39	5.81	21.09	25.73	92.48	1.85	40.85
12	Fruit yield per plant(kg)	5.25	11.54	9.39	31.75	32.50	98.92	4.27	54.48

Table 7: Genotypic (G) and Phenotypic (P) correlation coefficient for different pairs of characters in 36 F_1 hybrids of bottle gourd

Characters	Symbol	Days to first male flower anthesis	Days to first female flower anthesis	Node number to first male flower	Node number to first female flower	Vine length (m)	Number of nodes per vine	Number of primary branches per plant	Length of fruit (cm)	Weight per fruit(kg)	Number of fruits per plant	Fruit yield per plant(kg)
Days to fifty percent germination	G	0.149	0.113	0.323	0.245	0.269	0.189	0.083	-0.030	0.258	-0.186	0.200
	P	0.139	0.100	0.299	0.219	0.240	0.180	0.071	-0.030	0.209	-0.166	0.030
Days to first male flower anthesis	G		0.969**	0.169*	0.183	0.079	0.184	0.233	0.051	0.229	-0.215	0.105
	P		0.935**	0.166*	0.185*	0.063	0.184	0.222	0.049	0.17	-0.195	0.083
Days to first female flower anthesis	G			0.089	0.093	0.057	0.177	0.264	0.068	0.196	-0.175	0.141
	P			0.093	0.098	0.064	0.172	0.255	0.068	0.158	-0.179	0.117
Node number to first male flower	G				0.828**	0.228**	0.199*	0.191	0.056	0.292**	-0.338**	0.403*
	P				0.799**	0.232**	0.195*	0.192	0.057	0.234**	-0.322**	0.382*
Node number to first female flower	G					0.176*	0.202*	0.047	0.039	0.239**	-0.306**	0.526**
	P					0.173*	0.199*	0.048	0.039	0.179	-0.279**	0.501**
Vine length (m)	G						0.792**	0.413**	0.290**	0.494**	-0.023	0.365*
	P						0.764**	0.403**	0.281**	0.403**	-0.035	0.350*
Number of nodes per vine	G							0.390**	0.461**	0.523**	-0.024	0.395*
	P							0.380**	0.458**	0.417**	-0.014	0.390*
Number of primary branches per plant	G								0.112	0.514**	0.012	0.401*
	P								0.110	0.393**	0.011	0.390*
Length of fruit (cm)	G									0.549**	0.085	0.540**
	P									0.447**	0.081	0.534**
Weight per fruit(kg)	G										-0.190	0.747**
	P										-0.146	0.592**
Number of fruits per plant	G											0.580**
	P											0.553**

Table 8: Genotypic path coefficient analysis (direct and indirect effect) of yield contributing characters in 36 F_1 hybrids of bottle gourd

Characters	Days to fifty percent germination	Days to first male flower anthesis	Days to first female flower anthesis	Node number to first male flower	Node number to first female flower	Vine length (m)	Number of nodes per vine	Number of primary branches per plant	Length of fruit (cm)	Weight per fruit(kg)	Number of fruits per plant	Fruit yield per plant(kg)
Days to fifty percent germination	**-0.109**	-0.016	-0.012	-0.035	-0.027	-0.029	-0.020	-0.009	0.003	-0.028	0.020	0.200
Days to first male flower anthesis	-0.017	**-0.118**	-0.115	-0.020	-0.021	-0.008	-0.022	-0.027	-0.006	-0.027	0.025	0.105
Days to first female flower anthesis	0.012	0.106	**0.110**	0.009	0.010	0.006	0.019	0.029	0.007	0.021	-0.019	0.141
Node number to first male flower	0.005	0.003	0.001	**0.017**	0.014	0.004	0.003	0.003	0.001	0.005	-0.006	0.403
Node number to first female flower	-0.008	-0.006	0.003	-0.028	**-0.034**	-0.006	-0.007	-0.001	-0.001	-0.008	0.010	0.526
Vine length (m)	-0.006	-0.001	-0.001	-0.005	-0.004	**-0.025**	-0.020	-0.010	-0.007	-0.012	0.000	0.365
Number of nodes per vine	-0.000	-0.000	-0.000	-0.000	-0.000	-0.001	**-0.002**	-0.000	-0.001	-0.001	0.000	0.395
Number of primary branches per plant	0.010	-0.028	-0.032	-0.023	-0.005	-0.050	-0.048	**-0.123**	-0.013	-0.063	-0.001	0.401
Length of fruit (cm)	0.002	-0.004	-0.005	-0.004	-0.003	-0.024	-0.039	-0.009	**-0.085**	-0.046	-0.007	0.540
Weight per fruit(kg)	0.272	0.241	0.206	0.307	0.252	0.524	0.550	0.541	0.578	**1.052**	-0.200	0.744
Number of fruits per plant	-0.141	-0.163	-0.133	-0.256	-0.232	-0.018	-0.018	0.009	0.065	-0.144	**0.757**	0.580

At the phenotypic level presented in table-7 was observed that fruit yield per plant showed positive and significant correlation with weight per fruit (0.592) followed by number of fruits per plant (0.553), length of fruit (0.534), days to first female flower anthesis (0.517), node number to first female flower (0.501) and number of primary branches per plant (0.490). The number of fruits per plant showed positive and significant correlation with number of primary braches per plant (0.611) and vine length (0.535). The weight per fruit had positive and significant correlation with number of primary branches per plant (0.493) followed by length of fruit (0.447), number of nodes per vine (0.417) and vine length (0.403). The length of fruit showed positive and significant correlation with number of nodes per vine (0.458). The number of primary branches per plant had positive and significant correlation with number of nodes per vine (0.680) and vine length (0.503). The number of nodes per vine had positive and significant correlation with vine length (0.764). The node number to first female flower showed positive and significant correlation with node number to first male flower (0.799). Days to first female flower anthesis had positive and significant correlation with days to first male flower anthesis (0.935).

The path coefficient analysis was obtained for clear understanding of association of the genotypic correlation coefficient of yield with contributing components. The genotypic correlation coefficient was partitioned into direct and indirect effects through path coefficient analysis in hybrids are presented in table-8.

Highest positive direct effect on fruit yield per plant was exhibited by weight per fruit (1.052) followed by number of fruits per plant (0.757), number of primary branches per plant (0.123) and days to first female flower anthesis (0.110). Whereas, highest negative and direct effect towards fruit yield per plant was exhibited by days to first male flower anthesis (-0.118) followed by days to fifty percent germination (-0.109), length of fruit (-0.085) and node number to first female flower anthesis (-0.034).

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EFFECT OF POST HARVEST PACKAGING MATERIAL AND CALCIUM TREATMENTS ON THE QUALITY OF GUAVA DURING STORAGE

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ABSTRACT

The present investigations were carried out in Post Harvest Laboratory of Deptt. of Horticulture, during the years 2007 and 2008 to know the optimum concentration of calcium salts and to find out the best wrapping material for increasing shelf life of guava. Softening is a main postharvest problem of fresh guava (*Psidium guajava* Linn.) in India because this prefer consuming firm and crispy guava. $CaCl_2$ has been applied to many fresh produce to delay ripening and improve the firmness. 'Sardar' guava fruit harvested, after harvest were applied with 2 different concentrations of $CaNo_3$, $CaSo_4$ at 0.5%, 1%, and $CaCl_2$ 1%, 2% with a packaging material (newspaper) or without packaging material and then stored at room temperature at 12 days. Calcium treatments effectively maintained fruit firmness compared to non-treated fruit. Respiration of all treatments decreased after storage and remained stable without significance. Fruit infiltrated with 1% $CaCl_2$ showed slightly skin injury as scattered-browning generated around the fruit related to increasing be grading scales. There were significant between treatments in ascorbic acid, soluble solids and titrated acids contents. $CaCl_2$ infiltration at 2% showed a good option to maintain firmness.

Key word: Post harvest, calcium salts, newspapers, physic-chemical characters, guava

Guava, the apple of the tropics, is a popular fruit of India. It is available throughout the year except during summer months. It claims to be the fourth most important fruit in area and production after mango, banana and citrus. It is estimated that the cultivated area and the production of guava in India is 1,78,000 ha and 1.975 million tonns, respectively(N.H.B., 2008). Guava is quite hardy, prolific bearer and highly remunerative even without much care. The ripe fruits are the best relished by the rich and poor alike. They are rich in vitamin C which is 2-5 times more than fresh orange juice, and a fair source of vitamin A, Ca, Phosphorous, Pantothenic acid, riboflavin, thiamin and niacin. Guava fruits are the best for making jelly as these are rich in pectin. The fruit are packed in wooden boxes or bamboo baskets and transported to the market or processing unit. Fruit should never be packed in Hessian bags as it may cause considerable damage to the fruits even in short-distance transport. For long-distance transport, a layer of cushion material (dry grass, paddy straw, paper-wool etc) should be used at the bottom of the container. Refrigerated transport can reduce the spoilage of fruits.

Post harvest management of fruits comprises of different steps and packagings are one of them. Because packaging is the most fundamental tool for the post harvest management of highly perishable commodities.

Packaging is an essential and indispensable component at different steps of post harvest handling and adopted especially to reduce transportation losses. Post harvest Calcium treatments represent safe and effective methods for improving the quality and extending the storage life of fresh fruits. Calcium delays the process of ripening and more particularly softening, by altering intercellular and extra-cellular processes. $CaCl_2$ at ambient temperature retards softening and increase the shelf life. Wrapping of individual fruit reduced physical loss of weight (PLW) and retained better quality for longer time. Calcium also increases the storage life of fruit by decreasing the chance of infection of post harvest disease and internal break down. Calcium compounds extend the shelf life of fruits by also checking the protein breakdown and disintegration of tissues.

MATERIALS AND MATHODS

The present investigation was carried out at Post Harvest Laboratory of Department of Horticulture, College of Agriculture, G.B. Pant University of Agriculture and Technology, Pantnagar during December 2007 and December 2008. Prior to the application of post harvest treatments, fruits were sorted for uniformity of size and colour and blemished and diseased fruit were discarded. The selected fruit were thoroughly washed under the gentle stream of top water so as to remove the adhered dust and dirt particles. The experiment was consisted of three factor first factor packing material (newspaper wrapped fruit), second factor storage (0, 3, 6, 9 and 12days) and third factor chemicals (calcium nitrate 0.5%, calcium nitrate 1%, calcium chloride 1%, calcium chloride 2% calcium sulfate 0.5%, calcium sulfate 1% and control) with three replications in factorial Completely Randomized Design (C.R.D.). The observations on fruit TSS ^{0}Brix, Titrable acidity (%), ascorbic acid (mg/100g) and Total sugar (%) on stored fruits were also made.

RESULTS AND DISCUSION

Tota l Soluble Solids (^{0}Brix)

Perusal of data in Table 1 showed that packaging material had significant effect on total soluble solids of the fruit during both the years. Maximum TSS was found (10.40^{0}Brix and 10.96^{0}Brix) with wrapped fruits during both the years. Storage period also had pronounced effect on the TSS of the fruits. Maximum TSS was found at 6th days of storage and minimum TSS was found at 12th days of storage during both the years. Different chemical treatments also had significant effect on TSS. Maximum TSS was found with calcium chloride (1%) during both the years while minimum TSS was found with control treatment. Increase in total soluble solids during storage may be due to the breakdown of complex polymers into simple substances by hydrolytic enzymes which might be further metabolized during respiration and thus the level got decreased during subsequent storage (3) in guava and (1) in peach reported similar trend of increase and decrease in TSS of fruits during storage. This might be mainly due to slow conversion of starch into sugars. Maximum increase in TSS was observed in treated fruits with calcium chloride (1%) might be due to slow utilization of starch or sugars in oxidation process through Kreb's cycle. An increase in TSS with calcium dip was observed (19) in mango and (15) guava. Total soluble solids were found maximum in newspaper wrapped fruits kept in paper box in both the years during storage. The increase in total soluble solids might be due to slow conversion of insoluble sugars into soluble forms and least utilization of organic acids in respiration. The decrease in total soluble solids at the advanced stages is owing to its faster utilization in oxidation process through Kreb's cycle. TSS content of guava fruits increased initially up to 6th day of storage and decreased thereafter up to 12th day of storage period. This increase in TSS was mainly due to the reduction in activities of various enzymes and thereby delaying senescence, disorganization of cellular structure and checking of microbial activities (7).

Titratable acidity (%)

Careful analysis of data presented in Table 1 reflects that packaging materials, storage periods and different chemicals had significant effect on total titratable acidity of the fruits during both the years. Maximum total titratable acidity was found with wrapped fruits and lowest titratable acidity was found with unwrapped fruits during both the years. It was found that storage period also had significant effect on the total titratable acidity. The highest acidity was observed at the day of harvest and minimum was found at 12th days of storage during both the years. Total titratable acidity was affected significantly by different chemicals. Maximum titratable acidity was found in calcium chloride 1% and minimum was recorded in control during both the years. Acidity of the fruits decreased continuously in storage at room temperature. Maximum acidity was found in calcium chloride (1%) while its lowest value recorded in control. The decrease in acidity during storage might be due to conversion of acids into salts and sugars by the enzymes particularly invertase. Since low temperature retarded respiration rate there was slow conversion of acids into salts and sugars. Decrease in acidity during storage as a results of conversion of acids into salts and sugar has been reported by several workers in mango (8), kinnow (6), Banana (16), peach and apricot (9). Post harvest application of calcium chloride has been reported to reduce the acid content of peach (10) and guava (11) fruits. Data presented in Table 1 revealed that acidity was affected significantly by wrapping material in both the years. Maximum acidity was found in wrapped fruit kept in paper box. This might be due to quick metabolic transformation in soluble compounds and more conversion of organic acids into sugars during ripening. Similar findings were reported in mango (15).

Ascorbic acid (mg/100g)

A perusal of data presented in Table 2 revealed that effect of packaging material on ascorbic acid content was found significant during both the years. Highest ascorbic acid content was found in wrapped fruits and lowest ascorbic acid content was found in unwrapped fruits during both the years. Storage period significantly influenced the ascorbic acid content of the fruits during both the years. Ascorbic acid content was found highest at the day of harvest and lowest ascorbic acid content was found at 12th days of storage during both the years. Different chemicals had significant effect on the ascorbic acid content of the fruits. The highest ascorbic acid content was found in calcium chloride (1%) and lowest with control in first year. In the second year, highest ascorbic acid content was found in calcium nitrate (1%) and lowest with control.

These chemicals probably retard oxidation process and hence the rate of conversion of L-ascorbic acid into dehydroascorbic acid is slowed down. Higher retention of ascorbic acid due to calcium treatment has been reported in several fruits like guava (11), in mango (19) and in peach (10). The initial increase in ascorbic acid content of the fruit might be due to continuous synthesis of L-ascorbic acid from fruit sugar while the loss in ascorbic acid content of fruit during prolonged storage is mainly due to oxidation of L-ascorbic acid into dehydro ascorbic acid by the enzyme ascorbinase. (17) also found decreasing trend of ascorbic acid during storage of guava fruits. Fruits wrapped with newspaper kept in paper box maintained higher level of ascorbic acid content. Higher level of sugar in these fruits might be the possible reason for increase in ascorbic acid because ascorbic acid is synthesized from sugars. The results are in conformity with the result of (15). Ascorbic acid content in all the treatments decreased progressively with the storage period. The decrease in ascorbic acid was due to oxidative destruction of ascorbic acid in the presence of molecular oxygen by ascorbic acid oxidase enzyme (7). Similar results were reported (2) in guava, (12 and 14) in mango.

Table1: Effect of different post harvest treatments on the fruit TSS and acidity in guava cv. Sardar

Treatments	TSS (^{0}Brix)			Acidity (%)		
	2007	2008	Pooled	2007	2008	Pooled
Packing (W)						
Unwrapping	10.28	10.75	10.52	0.54	0.62	0.58
Wrapping	10.40	10.96	10.68	0.56	0.64	0.60
S.Em.±	0.029	0.023	0.026	0.003	0.004	0.004
C.D. at 5%	0.079	0.065	0.072	0.008	0.010	0.009
Storage days (D)						
0 days	10.31	10.98	10.65	0.68	0.70	0.69
3 days	10.81	11.46	11.14	0.56	0.67	0.62
6 days	11.35	11.97	11.66	0.53	0.64	0.59
9 days	10.16	10.36	10.26	0.51	0.61	0.56
12days	9.07	9.52	9.30	0.47	0.53	0.50
C.D. at 5%	0.125	0.111	0.118	0.013	0.015	0.014
Chemical (T)						
$Ca(NO_3)_2$0.5%	10.33	10.80	10.57	0.54	0.63	0.59
$Ca(NO_3)_2$1.0%	10.57	11.01	10.79	0.56	0.64	0.60
$CaCl_2$ 1.0%	10.65	11.09	10.87	0.56	0.66	0.61
$CaCl_2$ 2.0%	10.43	10.85	10.64	0.55	0.63	0.59
$CaSO_4$ 0.5%	10.19	10.80	10.50	0.54	0.62	0.58
$CaSO_4$ 1.0%	10.17	10.73	10.45	0.53	0.61	0.57
Control	10.04	10.71	10.38	0.54	0.63	0.59
C.D. at 5%	0.148	0.122	0.135	0.015	0.018	0.017

Total sugar (%)

It is evident from data presented in Table 2 showed that effect of packaging material, storage period and chemicals on total sugars was found significant in both the years. In case of packaging material, maximum total sugars was found in wrapped fruits as compared to unwrapped fruits. With respect of storage period, highest total sugar (7.49%) was recorded at 6th days of storage in first year, whereas, in second year total sugars was highest (7.35%) at 3rd days of storage, and minimum total sugar was recorded at 12th day of storage during both the years. Different chemicals showed significant effect on total sugar. Maximum total sugar (7.26% and 7.22%) was found with calcium chloride 1% and minimum total sugar (6.33% and 7.07%) was recorded with control during both the years. The increase in total sugar during storage might be because of an increase in reducing sugars and non reducing sugars resulting conversion of starch into simple sugar and later on reduction due to utilization of sugar in the process of respiration. The findings of (13) also support the contention that sugars initially increased and subsequently decreased during storage owing to calcium treatments. Similar results have also been obtained by (5) in grapes. The highest content of total sugar was obtained in the wrapped fruits kept in paper boxs. It might be due to high rate of respiration which requires rapid breakdown of the metabolite substrates (4). This increase in sugar might also be due to conversion of certain cell wall material such as pectin and hemicelluloses into reducing substance during prolonged storage (18).

There were significant between treatments in ascorbic acid, soluble solids and titrated acids contents. $CaCl_2$ infiltration at 2% showed a good option to maintain firmness.

Table 2: Effect of different post harvest treatments on the fruit Ascorbic acid (mg/100g) and Total Sugar (%) in guava cv. Sardar

Treatments	Ascorbic acid (mg/100g)			Total Sugar (%)		
	2007	2008	Pooled	2007	2008	Pooled
Packing (W)						
Unwrapping	253.07	233.57	243.32	6.98	7.12	7.05
Wrapping	255.22	237.01	246.11	7.17	7.18	7.17
C.D. at 5%	1.340	2.791	2.066	0.052	0.041	0.046
Storage days (D)						
0 days	263.39	263.72	263.55	7.03	7.32	7.17
3 days	260.78	253.82	257.30	7.11	7.35	7.23
6 days	258.52	238.60	248.56	7.49	7.18	7.33
9 days	249.63	220.57	235.10	7.21	7.03	7.12
12days	238.37	199.74	219.05	6.52	6.85	6.68
C.D. at 5%	2.118	4.413	3.266	0.082	0.064	0.073
Chemical (T)						
$Ca(NO_3)_2$0.5%	252.55	232.22	242.38	7.16	7.14	7.15
$Ca(NO_3)_2$1.0%	254.42	242.27	248.34	7.25	7.20	7.22
$CaCl_2$ 1.0%	257.55	240.63	249.09	7.26	7.22	7.24
$CaCl_2$ 2.0%	255.95	239.16	247.55	7.20	7.18	7.19
$CaSO_4$ 0.5%	254.25	234.32	244.28	7.17	7.14	7.15
$CaSO_4$ 1.0%	252.60	230.65	241.62	7.14	7.08	7.11
Control	251.67	227.79	239.73	6.33	7.07	6.70
C.D. at 5%	2.506	5.222	3.864	0.972	0.076	0.524

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GENETIC VARIABILITY STUDIES IN ONION (*Allium cepa* L.)

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ABSTRACT

An experiment on genetic variability study in onion was carried out in the rabi season involving 16 genotypes.. Wide variation was observed among the genotypes for all traits. Results revealed that the genotype cv. Pusa Madhavi, AOSDRB-0919 and AOSDRB-0913 performed better in terms of yield and yield attributing characters and therefore, these lines may be used for breeding programme. The highest phenotypic and genotypic coefficient of variations were recorded on yield per plot (16.96-15.81%), yield per ha (14.86-14.07%), bulb size (12.34-11.65%), plant height (12.00-11.57%) and bulb weight (14.27-11.57%). Similarly, the high heritability and genetic advance were also recorded on yield per plot (86.9 and 0.60%), yield per ha (89.6 and 7.30%), plant height (93.0 and 11.38%), bulb size (89.2 and 6.16%), and bulb weight (65.7 and 18.80%), being suggesting the major role of genetic constitution in the expression of the characters. Yield per ha had positive and highly significant correlation with yield per plot, TSS and bulb size both at phenotypic and genotypic level, respectively.

Key words: onion, variability, heritability, correlation coefficient

Vegetable crops, the important component of Horticulture, assume .great significance in providing food and nutritional security. Being effective supplements of nutrition, vegetables forms an important of daily diet of rich and poor alike. Among the vegetable crops, onion (*Allium cepa* L.) a bulbous, biennial herb belongs to family Liliaceae and Chromosome number (2n=2x=16), is an important vegetable bulb crop of tropical and sub-tropical region of the world. It is an important spice crop also. Keeping in view, the importance and utility of this crop an attempt has been made to find out the diversity. Improvement in yield and quality is normally achieved by selecting genotypes with desirable character combinations existing in the nature or by hybridization. Yet non-availability of required germplasm and no stability in desirable traits bring research gap in onion improvement programme. Keeping in view the above facts, the present investigation was undertaken to asses the magnitude of variability and correlation in 16 genotypes collected from Indian Institute of Vegetable Research, Varanasi.

MATERIALS AND METHODS

The present investigation was conducted at Horticulture Research Farm of the Department of Applied Plant Science, Babasaheb Bhimrao Ambedkar University, Vidya Vihar, Rae Bareli Road, Lucknow (U.P.) during the rabi season of 2009-10. Geographically, Lucknow is situated at an elevation of 111m above the Mean sea level in the Subtropical tract of central U.P. at $26^0 56'$ North latitude and $80^0 52'$ East longitude. For present investigation 16 germplasm lines of onion was undertaken. Seedlings of the germplasm were collected from the Indian Institute of Vegetable Research, Varanasi. The experiment was laid out in Randomized Block Design with three replications. Transplanting of seedlings was done during evening time on 18th January 2010 at a spacing of 15x10cm. The observations were recorded on 5 plants from each plot at randomly on plant height, number of leaves per plant, neck thickness, bulb diameter, bulb size, bulb weight, TSS, yield per plot and yield per ha. The data were analyzed to workout variance components and coefficient of variations as per suggested method by (2). Heritability in broad sense and expected genetic advance as percent of mean were estimated as suggested by (4) and correlation as by (1).

Table 1: Mean performance of 16 genotypes for 9 characters in onion.

S. No.	Characters Genotypes	Plant height (cm.)	Number of leaves per plant	Neck thickness (cm.)	Bulb diameter (cm.)	Bulb size (cm^2)	Bulb weight (g)	TSS (^{0}Brix)	Yield per plot(kg)	Yield (t/ha)
1.	AOSDRB- 0911	41.64	8.22	1.37	5.08	24.39	86.55	12.20	1.79	23.86
2.	AOSDRB-0914	43.75	8.33	1.23	5.26	26.62	96.22	12.05	1.97	26.22
3.	AOSDRB -0919	45.44	8.00	1.37	5.48	28.92	102.33	12.78	2.45	32.67
4.	CORB -0907	45.50	9.44	1.41	5.76	30.01	113.33	11.64	1.45	19.33
5.	AOSDRB-0909	46.51	8.44	1.21	5.18	25.66	91.66	12.07	1.60	21.33
6.	AOSDRB -0920	46.87	8.66	1.40	4.93	23.17	81.33	11.38	1.67	22.26
7.	AOSDRB -0904	47.53	8.77	1.27	5.53	28.03	100.33	12.52	1.93	25.89
8.	AOSDRB -0912	50.55	9.11	1.42	5.03	24.59	89.22	12.57	1.82	24.22
9.	AOSDRB- 0921	49.33	8.55	1.18	5.27	26.83	94.66	11.70	2.15	28.67
10.	AOSDRB-0910	54.11	8.89	1.30	4.94	23.94	87.00	12.97	2.13	28.45
11.	AOSDRB- 0906	41.43	8.22	1.20	4.84	23.08	81.88	12.07	1.63	21.55
12.	CORB- 0903	55.77	8.66	1.41	5.37	26.03	93.88	11.61	1.88	25.11
13.	AOSDRB-0913	50.11	8.55	1.53	5.48	28.87	101.22	13.31	2.40	31.96
14.	CORB- 0902	59.27	9.11	1.42	5.79	30.42	107.77	13.16	1.88	25.11
15.	AOSDRB-0922	53.66	8.67	1.49	5.61	28.93	101.11	13.27	2.23	29.78
16.	Pusa Madhvi	60.32	9.77	1.41	6.12	35.32	128.44	12.90	2.52	33.56
	GM(X)	**49.48**	**8.71**	**1.35**	**5.35**	**27.17**	**97.30**	**12.38**	**1.96**	**26.60**
	CD at 5%	**2.615**	**0.649**	**0.122**	**0.543**	**1.835**	**13.558**	**0.469**	**0.200**	**2.119**

RESULTS AND DISCUSSION

The analysis of variance was highly significant for all the characters (Table 1). The highest bulb diameter (6.12 cm), bulb size (35.32m^2) and bulb weight (128.44g) were observed for Pusa Madhvi, which was at par with CORB-0902 (5.74cm), (30.42 cm^2) and CORB-0907 (113.33g), respectively. Highest yield per plot (2.52kg) and yield per ha (33.56 tones per ha) was also recorded for cv. Pusa Madhvi, which was at par with AOSDRB-0919 (2.52 kg), (32.67 tones per ha).

The extent of variability with respect to various characters in different genotypes measured in terms of range, general mean, Genotypic coefficient of variation, Phenotypic coefficient of variation, with the amount of heritability (h^2) and expected genetic advance as percent of mean (Table 2). The range of variation was highest for bulb weight (81.33

–128.44g), plant height (41.43–60.32 cm), bulb size (23.08–35.32cm^2) and yield (21.33–32.67 t/ha). The remaining characters, viz. TSS (11.38-13.27^{0}brix), number of leaves per plant (8.00–9.77), bulb diameter (4.84–6.12cm), yield per plot (1.45–2.52 kg) and neck thickness (1.18–1.53 cm) showed medium to low range of variability.

Table 2: Range, mean, genotypic, phenotypic and environmental variance, coefficient of variability, heritability and genetic advance for different characters in onion.

S. No.	Characters	Range		General mean (±SE)	Genotypic variance	Environmental Variance	Phenotypic variance	GCV	PCV	Heritability (%) ha2 (B.S.)	Genetic advance	Genetic advance as % of mean
		Min.	Max.									
		1	2	3	4	5	6	7	8	9	10	11
1.	Plant height (cm.)	41.43	60.32	49.487	32.78	2.46	35.24	11.57	12.00	93.0	11.38	22.99
2.	Number.of leaves/plant	8.00	9.77	8.712	0.16	0.15	0.31	4.70	6.50	52.4	0.61	7.00
3.	Neck thickness (cm.)	1.18	1.53	1.351	0.01	0.00	0.01	7.27	9.10	63.8	0.16	11.85
4.	Bulb diameter (cm.)	4.84	6.12	5.354	0.09	0.10	0.19	5.65	8.32	46.2	0.42	7.85
5.	Bulb size (cm^2)	23.08	35.32	27.174	10.02	1.21	11.23	11.65	12.34	89.2	6.16	22.67
6.	Bulb weight (g)	81.33	128.44	97.309	126.74	66.13	192.87	11.57	14.27	65.7	18.80	19.32
7.	TSS (^{0}Brix)	11.38	13.27	12.387	0.37	0.07	0.44	4.95	5.45	82.5	1.15	9.28
8.	Yield per plot (kg)	1.45	2.52	1.968	0.09	0.01	0.10	15.81	16.96	86.9	0.60	30.61
9.	Yield (t/ha)	19.33	33.56	26.44	14.00	1.61	15.61	14.07	14.86	89.6S	7.30	27.44

The Genotypic coefficient of variation, was less than that of Phenotypic coefficient of variation for all characters (Table- 2), indicating the effect of environment on the genetic expression, the Genotypic coefficient of variation, and Phenotypic coefficient of variation, were high for yield per plot (15.81–16.96 %), yield tones per ha (14.07–14.86 %), bulb size (11.65–12.00 %) and bulb weight (11.57 – 14.27) and moderate to low for remaining traits. This variation indicated the possibility of obtaining very high selection response with respect to these traits.

Heritability estimate provides the assessment of amount of transmissible genetic variability to the total variability and happens to be the most important basic factor that determines the genetic improvement or response to selection. The heritability in broad sense was ranged from 46.2 to 93.0%. High heritability was expressed for plant height (93.0%) followed by yield (tones per ha) (89.6%), bulb size (89.2%), yield per plot (86.9%), TSS (82.5%), bulb weight (65.7%), neck thickness (63.8%), number of leaves per plant (52.4%) and bulb diameter (46.2%). (7), has categorized estimates of heritability as low (5-10%) medium (10-30%)

and high (30 and above). Following this classification the heritability estimates obtained were high for all the characters, indicating low environmental effects and selection based on phenotypic performance would be reliable. Similar results were also reported by (3).

The parameters genetic advance in percent of mean is a more reliable index for understanding the characters because its estimate is derived by involvement of deviation and intensity of selection. The genetic advance as percent of mean ranged between 7.00% to 30.61%. The genetic advance in percent of mean was highest in case of yield per plot (30.61%) followed by yield per ha. (27.44%), plant height (22.99%), bulb size (22.67%), bulb weight (19.32%). Thus, heritability and genetic advance in percent of mean in combination, provides more clear picture regarding the effectiveness of selection for improving the characters. In the present study, the traits, yield per plot, yield per ha, plant height, bulb size and bulb weight showed high heritability coupled with high genetic advance as percent of mean whereas neck thickness, TSS, bulb diameter and number of leaves per plants showed high heritability with low genetic advance. The characters which exhibit high heritability with high genetic advance as percent of mean are genetically controlled by additive gene actions (6) and can be improved through mass selection or any other modified selection procedure. Where the traits exhibit high heritability with moderate to low genetic advance as percent of mean these can be improved through multiple crosses.

Table 3: Estimate of phenotypic and genotypic correlation coefficient for 9 characters in Onion.

Characters		Plant height (cm.)	No of leaves / plant	Neck thickness (cm.)	Bulb diameter (cm)	Bulb size (cm^2)	Bulb weight (g)	T.S.S (° Brix)	Yield/plot (kg)	Yield/ ha(tones)
Plant height (cm.)	G	1.000	0.798**	0.496*	0.683**	0.581**	0.581**	0.502*	0.484*	0.380
	P	1.000	0.484*	0.390	0.428	0.514*	0.459*	0.423	0.414	0.329
No of leaves / plant	G		1.000	0.427	0.747**	0.647**	0.790**	0.219	0.025	0.012
	P		1.000	0.290	0.430	0.505*	0.493*	0.066	0.024	0.047
Neck thickness (cm.)	G			1.000	0.502*	0.404	0.389	0.514*	0.296	0.366
	P			1.000	0.351	0.365	0.323	0.354	0.298	0.357
Bulb diameter (cm)	G				1.000	0.600**	0.661**	0.445	0.517*	0.560**
	P				1.000	0.850**	0.877**	0.310	0.317	0.373
Bulb size (cm^2)	G					1.000	0.837**	0.464*	0.556**	0.584**
	P					1.000	0.917**	0.415	0.495*	0.533**
Bulb weight (g)	G						1.000	0.411	0.508*	0.563**
	P						1.000	0.319	0.362	0.398
T.S.S (° Brix)	G							1.000	0.697**	0.664**
	P							1.000	0.577**	0.577**
Yield/plot (kg)	G								1.000	0.978**
	P								1.000	0.925**
Yield/ ha (tones)	G									1.000
	P									1.000

Genotypic correlation coefficient suggesting inherent relationships in different genotypes, where as the phenotypic correlation may be attributed to the modifying effect of the environment on the association of the characters at the genotypic level (Table-3). The yield per ha had positive correlation coefficient with all the characters in the parental population. (5) also reported all the characters in garlic were positively correlated with yield. The success of direct selection depends on the genetic variability among characters. The yield per ha had highly significant and positive correlation with yield per plot, T.S.S, bulb size both at phenotypic and genotypic levels, whereas with bulb weight and bulb diameter at genotypic level only. (8) also showed strong positive correlation with bulb weight. (9) also reported, yield had strong positive correlation with bulb diameter, bulb size and bulb weight. Yield per plot showed positive and highly significant association with TSS and bulb size both at phenotypic and genotypic levels where as with bulb diameter, bulb weight and plant height had positive and significant correlation only at genotypic level. TSS had positive and significant correlation with plant height, bulb size and neck thickness at genotypic level. Bulb weight had positive and highly significant correlation with bulb size, bulb diameter, number of leaves per plant and plant height both at genotypic and phenotypic level. Bulb size had positive and highly significant correlation with bulb diameter, plant height and number of leaves per plant both at genotypic and phenotypic level. Bulb diameter showed positive and highly significant association with number of leaves per plant, plant height, and neck thickness at genotypic level only. Neck thickness had positive and significant association with plant height at genotypic level only. Number of leaves per plant had positive and highly significant association with plant height at genotypic level only.

The present study showed that the bulb weight, bulb size, bulb diameter, neck thickness and number of leaves per plant were the most important characters correlated to yield and yield attributing traits.

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STUDIED THE INTERACTION AND ECONOMICS OF NITROGEN AND PHOSPHORUS ON CROP GROWTH, RELATING TRAITS OF BROCCOLI (*Brassica oleracea* L. var. *italica*)

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ABSTRACT

An experiment was conducted at department of vegetable science, C.S.Azad University of Agri.& Technology Kalyanpur, Kanpur during *kharif* seasons of 2005-06 to find out the interaction and economics of Nitrogen and Phosphorus on crop growth of Broccoli variety green head Randomized Block Design was selected with four levels of Nitrogen (30,60,90,120 kg/ha) and three levels of Phosphorus (30,60,90 kg/ha) with its basal dose of. K$_2$O @ 60kg/ha. As the regards the yield of Broccoli, Nitrogen & Phosphorus both showed direct response more pronouncely at the 90 kg/ha of fertilization. The results revealed significantly increased in the head yield of Broccoli (Nitrogen 170.15 and Phosphorus 160.38 q/ha., respectively).the significant result was found in the interaction of Nitrogen and Phosphorus 175.70 q/ha the maximum cost -benefit ratio was found 1:2.1.

Key words: Broccoli, Economic, Nitrogen, Phosphorus.

Broccoli (*Brassica oleracea* L. var. *italica*) belong to family Cruciferae (Brassicaceae) is an important vegetable crop for protein 3.3 percent, thiamine, raicin riboflavin. Green type is the most nutritive and popular because it contains the anticancer property sulphoruphane. Broccoli head resembles cauliflower consisting of clusters of green flower buds. Near to city farmer can fetch more money by cultivating broccoli. The head is harvested along with a few leaves and stem (10-15 cm) yield of this crop ranges between (0.5-1.5 t ha^{-1}) depending upon the variety, time of planting and harvesting duration. In India Broccoli was hardly regarded as a commercial crop till recently and that's why no authentic statistics pertaining to area and production is available. In Uttar Pradesh, Broccoli is most important crop in a view about 130 times more vitamins "Ä" then cauliflower and 22 times more than cabbage and a rich source of sulphoraphane which is compound associated with reducing the risk of cancer . the farmers do not know its importance and production technology, has not also been standardized.

MATERIALS AND METHODS

The experiment was conducted at Departmental Farm of Vegetable Science, Chandra Shekhar Azad University of Agriculture and Technology, Kanlyanpur Kanpur during the rabi season. Four treatments of nitrogen (30, 60, 90, 120) kg ha^{-1} and three treatments of phosphorus (30, 60, 90) kg ha^{-1} there are twelve treatment combination farm yard manure @ 20 t ha^{-1} along with as a common dose in all treatment and entire quantity of Phosphorus and one third of Nitrogen as per treatment was applied in the farm of single super phosphate and urea, respectively before transplanting at the time of field preparation remaining nitrogen was given in two splits at 30 and 45 days after transplanting. The trail was laid out in randomized block design with three replications. Total numbers of treatment combination were 12 with one control and total number of plants / plot were 48. The observations were recorded at appropriate stage of plant.

RESULTS AND DISCUSSION

The present data in Table-1 reveled that the effect of Nitrogen significantly plant height increased with increased with increasing level of Nitrogen upto 90 kg ha^{-1}. Similarly increased level of Phosphorus the plant height was also increased significantly maximum plant height was recorded 51.75 cm which was over 30 an 60 kg N ha^{-1}. Highest plant height 52.07 was recorded when Phosphorus was applied 90 kg ha^{-1}. Days to central head of application of 90 kg ha^{-1} Nitrogen and Phosphorus separately were around significant response over 30 kg ha^{-1} Nitrogen and Phosphorus. The minimum days (58.44) for appearance head was recorded at the level 90 kg ha^{-1} same level of Phosphorus minimum days 58.17 was recorded head yield increased significantly upto level of 90 kg ha^{-1} and higher yield was recorded 170.15 q ha^{-1} in case of Phosphorus application increasing tend was found treatment of 90 kg P_2O_5 ha^{-1} significant result and yielded 160.38 q ha^{-1}. As in plant frame application of Nitrogen and Phosphorus individually significantly influenced plant frame, maximum plant spread 68.54 cm with Nitrogen application was noticed at 90 kg ha^{-1} which was higher than 60, 30 kg N ha^{-1} (Table-1) maximum plant spread (70.67 cm) was significantly recorded at the treatment of 90 kg P_2O_5 ha^{-1} over 60 and 30 kg P_2O_5 ha^{-1} and plant spread was 65.65 cm and 63.7 cm respectively.

As in the case of Head size Nitrogen application of 90 kg ha^{-1} produced largest size (90.77 cm^2) which was superior over all the level of Nitrogen and in P_2O_5 90 ha^{-1} was found to produce bigger size (96 cm^2) over the lower levels of Phosphorus. Interaction of Nitrogen and Phosphorus also influenced the head size significantly.

The Nitrogen and Phosphorus applied individually were effective in exerting their impact on harvest duration period of availability of produce was increased with 90 kg ha^{-1} level of Nitrogen, different levels of Phosphorus applied 90 kg ha^{-1} gave significant response at harvest duration of 38.08 days which was higher over the days 36.83 and 35.50 at the level of 60 and 30 kg P_2O_5 respectively. In the case of compactness none of Nitrogen and Phosphorus either alone or in combination was able to respond effectively treatment produced medium compactness of head (Table-2).

As in plant height increased linearly by the application of Nitrogen 90 kg ha^{-1} produced significantly taller plant than 30 and 60 kg N ha^{-1}. Nitrogen showed its significance in enhancing the plant spread upto 90 kg ha^{-1}.The increase in yield contributing characters like plant spread and head size ultimately affected the head yield and the highest yield / hectare were recorded at 90 kg N ha^{-1}. Harvest duration increased significantly with every increment in level of Nitrogen upto 90 kg ha^{-1}. The reduction in the produced availability with increased size of the central heads at this Nitrogen rates which other prolong duration..

In the case of Phosphorus the tallest plants produced by 90 kg P_2O_5 ha^{-1} differ significantly from other levels. No effect on days to central head formation was recorded by Phosphorus application. Maximum plant spread by the application of 90 kg P_2O_5 ha^{-1} in comparison to 30 and 60 kg P_2O_5 ha^{-1}. As plant spread and head size were increased by the application of Phosphorus up to 90 kg P_2O_5 ha^{-1}.

Harvest duration was significantly enhanced by the ascending Phosphorus levels upto the highest levels (90 kg P_2O_5 ha^{-1}).

The interaction effect in head size was found significant with the application of 90 kg N and 90 kg P_2O_5/ha. However, remaining interaction were found non- significant with application of different doses of Nitrogen and Phosphorus. The interaction effect on maximum cast benefit ratio of 1:2.1 was obtained at a treatment combination of 90 kg N and 90 kg P_2O_5/ha for head production of broccoli.

Table 1: Effect of nitrogen and phosphorus in different character on broccoli.

Treatment	Plant height (cm)	Days to central head	Head yield (q ha^{-1})	Plant frame	Head size (cm^2)	Harvest duration days
(A)Nitrogen levels (kg ha^{-1})						
30	78.71	59.67	136.10	64.26	84.08	36.22
60	50.99	59.11	149.13	67.52	85.88	36.69
90	51.75	58.44	170.15	68.54	90.77	37.56
120	50.47	59.44	159.60	66.38	86.55	36.56
C.D. at 5%	1.11	1.23	5.23	1.26	3.09	0.66
(B)Phosphorus levels (kg ha^{-1})						
30	49.09	60.16	145.97	63.71	80.25	35.50
60	50.27	59.17	154.87	65.65	84.15	36.83
90	52.07	58.17	160.38	70.67	96.04	38.08
C.D. at 5%	0.96	1.07	4.53	1.09	2.68	0.57
(C)Control V/S treatment	46.12	62.67	83.10	58.42	74.38	28.33
C.D. at 5%	1.41	1.57	6.67	1.60	3.94	0.8462

Table 2: Compactness of the head.

Treatment	Number of heads		
	Loose	Medium	Compact
N_1P_1	9	11	10
N_1P_2	8	12	10
N_1P_3	7	12	11
N_2P_1	8	12	10
N_2P_2	10	11	9
N_2P_3	8	12	10
N_3P_1	8	12	10
N_3P_2	6	13	11
N_3P_3	7	10	13
N_4P_1	7	11	12
N_4P_2	9	10	11
N_4P_3	10	11	9
N_oP_o	13	10	7
Average	8.46	11.31	10.23
Total number of heads examined for each treatment = 3X 10 = 30			

N_o= 0kgN N_1=30kgN N_2=60kgN N_3=90kgN N_4=120kgN

P_o=0kgP P_1=30kgP P_2=60kgP P_3=90kgP

ECONOMICS

Application of Nitrogen (90 kg/ha) gave significantly higher net return Rs. 91464.00) and cost- benefit ratio (1:2.05) over the control and other levels of Nitrogen. Thus increase in net return is due to the fact that head yield was also significantly higher with 90 kg N/hg as compared to other levels of Nitrogen. Similarly the application of 90 kg P_2O_5/ha gave net return of Rs. 83218.00 and cost benefit ratio of 1:1.85 Application of 90 kg/ha Nitrogen and 90 kg/ha phosphorus either along or in combination proved beneficial far head production.

Nitrogen and phosphorus both were effective on sandy loam soil at kanpur for the production of broccoli. Most of the characters were favored by applying 90 kg Nitrogen and 90 kg Phosphorous per hectare. Optimum head yield of broccoli can thus, be obtained by applying 90 kg N+ 90 kg P_2O_5/ha. (Table-3)

Table 3 : Economics of Broccoli Head Production as affected by Nitrogen and Phosphorus.

Treatment	Head yield/q ha^{-1}	Gross income (Rs. ha^{-1})	Expenditure (Rs. ha^{-1})	Net returns (Rs. ha^{-1}	C:B ratio
(A) Nitrogen (Kg ha^{-1}					
N_1(30)	136.10	108880	43969	64610	1.47
N_2(60)	149.13	119304	44363	74941	1.69
N_3(90)	170.15	136120	44656	91464	2.05
N_4 (120)	159.60	127680	44950	82730	1.84
(B) Phosphorus (kg ha^{-1})					
P_1(30)	145.97	116776	44213	72563	1.64
P_2(60)	154.87	123896	44650	79246	1.77
P_3(90)	160.38	128304	45086	83218	1.85
(C) Interaction effect					
N_1P_1	124.20	99360	44406	54954	1.24
N_1P_2	138.85	111080	44843	66237	1.48
N_1P_3	145.25	116200	45279	70921	1.57
N_2P_1	142.80	114240	44800	69440	1.55
N_2P_2	149.25	119400	45237	74163	1.64
N_2P_3	155.33	124264	45673	78591	1.70
N_3P_1	163.45	130760	45093	85667	1.90
N_3P_2	171.30	137040	45439	91601	2.02
N_3P_3	175.70	140560	45875	94685	2.06
N_4P_1	153.45	122760	45387	77373	1.70
N_4P_2	160.10	128080	45824	82256	1.80
N_4P_3	165.25	132200	46260	85940	1.86
N_0P_0	83.10	66480	43776	22704	0.52

Market Price @ Rs. 800 q^{-1}

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A STUDY OF INFRASTRUCTURAL PROFILE AND CONSTRAINTS OF CUT FLOWER GROWERS

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ABSTRACT

The present study was conducted during the year 2007-08 n Muzaffer Nagar district of western Uttar Pradesh. To know the infrastructural profile and constraint's of cut flower growers. It was observed that the most of cut flower grower were fully satisfied from availability of market in the vicinity, planting meterials, transport facility, credit facility, marketing information, farm advisory service from KVK scientists/Agril. extension workers, fertilizers sale depots and availability of literature on cut flower cultivation. Partially satisfied from auction platform and unsatisfied from covered space of loading-unloading, platform of post harvesting, cold storage, processing at farm level, training programmes, demonstration, packaging materials and improved implements. The major constraints of cut flower grower were: problem of wild animals ranked in first, problem of land shifting ranked in second, problem of eratic supply of electricity ranked in third, less provision of flower fair/exhibitions ranked in fourth, problem of interference of middleman in credit facility and marketing system ranked in fifth and sixth respectively, lack of technical communication facilities ranked in seventh, problem of unnecessary charges by police man at barrier/police chouki ranked in eight place.

Key words: Cut flower growers, infrastructural profile, constraints, primary and secondary data.

Gladiolus is leading cut flower of India as well as of world. Gladiolus is very much liked for it's majestic spikes whish contain attractive elegant and delicate florets. These florets open in sequence from lower floret to upper floret. There is a wider range of flower colors. The spikes of gladiolus are mainly used for garden, interior decoration and for making bouquets. At present Meerut region is producing 115890 quintal loose flower from an area of 2650 ha. with an average yield of 43.73 q/ha. during the year 2006-07, (Anonymous, 2008), while all India production of loose flower 655 thousand million tones from an area of 116 thousand million ha. with an average yield of 56.50 q/ha. during the year 2004-05, (N.H.B. Data Base, 2005). In India, flower are growing in all the states; namely Uttar Pradesh, Andhra Pradesh, Tamil Nadu, Karanataka, Haryana, Maharashtra, West Bangal, Gujarat, Delhi, Orissa, Himachal Pradesh, Bihar, Madhya Pradesh., Jammu and Kashmir., Manipur, Uttaranchal, Daman & Mizoram, Jharkhand, Pandecheri and Sikkim. However, Tamil Nadu is the largest flower producing state in the country which producer 187342 million tones flowers from an area 23233 ha. with an average yield of 80.64 q/ha. Keeping in view the main objective of the study was to find out the infrastructural profile and constraints of cut flower growers.

MATERIALS AND METHODS

This study was conducted in Khatauli block in MuzaffarNagar district of Western Uttar Pradesh during the year 2007-08. Five villages were selected from Khatauli block for the investigation. From each village 20 cut flower grower were selected. Thus the total sample size was of 100 cut flower growers. The data were collected through personal interview with the help of pre structured schedule. The data were analyzed statistically, to find out the percentage and rank order.

RESULTS & DISCUSSION

The data of parameter Ist presented in table-1, reveals that the 100 per cent of cut flower grower were fully satisfied from vicinity of market. There were not any one in the categories of partially satisfied and unsatisfied.

Table 1: Infrastructural profile of cut flower grower with respect to place.

Variable	Parameters	FS		PS		US	
		F	%	F	%	F	%
Infrastructural facilities	1. Availability of Market in the Vicinity	100	100	-	00	-	00
	2. Auction platforms	5	5	60	60	35	35
	3. Covered space for loading-unloading	0	0	15	15	85	85
	4. Availability of platform for post harvest	2	2	16	16	82	82
	5. Availability of cold storage facilities	0	0	2	2	98	98
	6. Availability of processing facility at farm level	0	0	0	0	100	100

FS- Fully satisfied, PS- Partially satisfied, US- Unsatisfied.

In second parameter the majority of 60 per cent respondents satisfied from auction platform, followed by 35 per cent respondents were unsatisfied from auction platform and the remaining 5 per cent respondents were fully satisfied from auction platform (table-1).

The parameter 3rd in table-1, revealed the majority 85 per cent cut flower grower were unsatisfied from covered space for loading and unloading of cut flowers, while 15 per cent cut flower grower were partially satisfied from covered space for loading and unloading of cut flower and there was not any one in the category of fully satisfied from covered space for loading and unloading of cut flowers.

The data of parameter 4th in table-1, indicated that the majority of 82 per cent cut flower grower were unsatisfied from availability of platform for post harvesting, followed by 16 per cent cut flower growers were partially satisfied from availability of platform for post harvesting and the remaining 2 per cent cut flower grower were fully satisfied from availability of platform for post harvesting.

The parameter 5th in table-1 depicted that the majority of 98 per cent cut flower growers were unsatisfied from availability of cold storage facilities, while 2 per cent cut flower growers were partially satisfied from availability of cold storage facilities and there were not any one in the category of fully satisfied from cold storage facilities.

The parameter 6th in table-1 indicated that the majority of 100 per cent cut flower growers were unsatisfied from availability of processing facilities at farm level and there were not any one in the categories of fully satisfied and partially satisfied.

Table 2: Infrastructural profile of cut flower grower with respect to media exposure.

Variable	Parameters	FS		PS		US	
		F	%	F	%	F	%
Infrastructural facilities	1. Availability of marketing information	60	60	24	24	16	16
	2. Farm advisor services to the farmers from KVK Scientists/ Argil	79	79	16	16	5	5
	3. Training programme for cut flower growers	15	15	21	21	64	64
	4. Demonstration on cut flower cultivation	6	6	9	9	85	85
	5. Availability of literature on cut flower	96	96	4	4	0	0

In parameter 1st, table-2, indicated that the majority of 60 per cent cut flower growers were fully satisfied from availability of marketing information, whereas 24 per cent cut flower growers were partially satisfied from availability of marketing information and the remaining 16 per cent cut flower growers were unsatisfied from availability of marketing information.

The parameter 2nd in table 2, indicated that the majority of 79 per cent cut flowers growers were fully satisfied from the farm advisory services, which provided by the KVK scientists/Argil. Extension workers, while 16 per cent cut flower growers were partially satisfied from the advisory services and the remaining 5 per cent cut flower growers were unsatisfied from the farm advisory services.

The parameter 3rd in table-2, depicted that the majority of 64 per cent cut flower growers were unsatisfied from training programmes because number of training programmes were not sufficient, while 21 per cent cut flower grower were partially satisfied from training programmes and the remaining 15 per cent cut flower growers were fully satisfied from training progrmmes.

The parameter 4th table-2, revealed that the majority of 85 per cent cut flower growers were unsatisfied from cut flower crop flower crop demonstration at farmer field which conduct by the SVBP University scientists. due to less number of demonstration and irregular visit at farmers field. Whereas 9 per cent cut flower growers were partially satisfied and the remaining 5 per cent cut flower growers were fully satisfied from the cut flower crop demonstration.

The parameter 5th in table-2, indicated that the majority of 96 per cent cut flower growers were fully satisfied from availability of literature on cut flower cultivation, whereas 4 per cant cut flower growers were partially satisfied from available of literature on cut flower cultivation and there was not any one cut flower grower in the category of unsatisfied.

The parameter 1st in table-3, indicated that the majority of 73 per cent cut flower growers were fully satisfied from availability of planting materials of cut flower while kumar at al.(200) observed that farmers were not satisfied with planting materials followed by 19 per cent cut flower growers were partially satisfied from availability of cut flower planting materials and the remaining 8 per cent of cut flower growers were unsatisfied from availability of planting materials of cut flower.

Table 3 : Infrastructural profile of cut flower growers with respect to availability of planting materials and sales depots.

Variable	Parameters	FS		PS		US	
		F	%	F	%	F	%
Infrastructural facilities	1. Availability of planting materials	73	73	19	19	8	8
	2. Packaging materials	4	4	7	7	89	89
	3. Agro-chemical sale deposit	14	14	32	32	54	54
	4. Fertilizers sale depots/ shops	94	94	2	2	4	4
	5. Improved agriculture implements	6	6	12	12	82	82

The parameter 2nd in table-3, revealed that the majority of 89 per cent cut flower growers were unsatisfied from availability of packaging materials, followed by 7 per cent cut flower grower were partially satisfied from availability of packaging materials and the remaining 4 per cent cut flower growers were fully satisfied from availability of packaging materials.

The parameter 3rd in table-3 revealed that the majority of 54 per cent cut flower growers were unsatisfied from agro-chemicals sale depots, whereas 32 per cent cut flower growers were partially satisfied from agro-chemicals sale depots and the remaining 14 per cent cut flower growers were fully satisfied from agro-chemical sale depots.

The parameter 4th in table-3, obvious that the majority of 94 per cent cut flower grcwers were fully satisfied from fertilizers sale depots, while 2 per cent cut flower growers were partially satisfied from fertilizers sale depots and the remaining 4 per cent cut flower growers were unsatisfied from fertilizers sale depots.

The parameter 5th in table-3 reveled that the majority of 82 per cent cut flower growers were unsatisfied from improved implements, while 12 per cent cut flower growers were partially satisfied from improved agriculture implements and the remaining 6 per cent cut flowers were fully satisfied from improved agriculture implements.

Table 4: Infrastructural profile of cut flower growers with respect to availability of agriculture labour, transport and credit facilities.

Variable	Parameters	FS		PS		US	
		F	%	F	%	F	%
Infrastructural facilities	1. Availability of labour	46	46	37	37	17	17
	2. Transport facilities	96	96	2	2	2	2
	3. Availability of credit facilities	80	80	15	15	5	5

The parameter 1st in table-4, indicated that the majority of 46 per cent cut flower growers were fully satisfied from availability of labour, followed by 37 per cent cut flower growers were partially satisfied from availability of labour and the remaining 17 per cent cut flower growers were unsatisfied from availability of labour.

Parameter 2nd in table-4, revealed that the majority of 96 per cent cut flower growers were fully satisfied from transport facilities, whereas 2 per cent cut flower growers were partially satisfied from transport facilities and the remaining 2 per cent cut flower growers were unsatisfied from transport facilities.

Parameter 3rd, in table-4, obvious that the majority of 80 per cent cut flower growers were fully satisfied from availability of credit facilities, while 15 per cent cut flower growers were partially satisfied from availability of credit facilities and the remaining 5 per cent cut flower growers were unsatisfied from availability of credit facilities.

Table-5: Constraints of cut flower growers with respect to cut flower production and marketing

S.No.	Constraints	No. of respondent	Per cent	Rank
i	Problem of eratic supply of electricity.	89	89	3rd
ii	Problem of interference of middleman in marketing system.	69	69	6th
iii	Problem of interference of middleman in credit facilities system.	72	72	5th
iv	Problem of land sifting	95	95	2nd
v	Unnecessary change by policeman at barrier/police chauki	50	50	8th
vi	Unavailability of subsidy on Agriculture inputs	41	41	9th
vii	Unavailability of labor at proper time	33	33	10th
viii	Less provision of flower fairs/exhibitions	85	85	4th
ix	Problem of wild animals.	100	100	1st
x	Lack of technical communication facilities	64	64	7th

The data with respect to cut flower grower's constraints presented in table-5, reveals that the ranks of constraints given in order were problem of wild animals (100 per cent), it was ranked in first. Problem of land sifting (95 per cent), it was ranked in second. Problem of eratic supply of electricity (89 per cent), it was ranked in third. Less provision of flower fairs/Exhibitions (85 per cent), it was ranked in fourth. Problem of interference of middleman in credit facilities system (72 per cent), it was ranked in fifth. Problem of interference of middleman in marketing system (69 per cent), it was ranked sixth. Lack of high technical communication facilities, it was ranked in seventh, finding are supported by Trade et al. (2005). Unnecessary charges by the policeman at Police Chouki/barrier (50 per cent), it was ranked in eight. Unavailability of subsidy on agriculture input (41 per cent), it was ranked in ninth and unavailability of labour a proper time (33 per cent), it was ranked in tenth.

It can be concluded from the above study that the most of cut flower growers were satisfied from availability of market in vicinity marketing information, farm advisory service, literature of cut flower, planting material, fertilizer sale depots, labour, transport and credit facilities. Partially satisfied from auction platform and unsatisfied from loading and unloading space, post harvesting platform, cold storage facility, processing facility at farm level, training programmes, demonstrations, packaging materials and improved implements. The major constraints of cut flower growers were problem of wild animals, problem of land sifting, problem of eratic supply of electricity, problem of interference of middle man in credit facilities and marketing system, less provision of flower, fairs/exhibitions and problem of unnecessary changes by policeman at barrier/police chauki.

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ASSOCIATION ANALYSIS IN ELITE GERMPLASM LINES IN CORIANDER (*CORIANDRUM SATIVUM* L.)

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ABSTRACT

The experiment was undertaken on nine genotypes namely 2007, 8918, 2002, 9903, 9106, 9807, 2015, 2108 (germplasm lines) including check variety Azad Dhania-1 of coriander (*Coriandrum sativum* L.). The materials were evaluated in an augmented Randomized Block Design with three replications during the *rabi* season of 2009-10. Efforts have been made to study the association of component traits with seed yield. It came into account that seed yield was significantly and positively correlated with its component characters like the number of primary branches plant^{-1} (rg = 0.750 and rp = 0.581**), number of secondary branches plant^{-1} (rg = 0.471* and rp = 0.431*), number of umbels plant^{-1} (rg = 0.932** and rp = 0.801**), number of umbellets plant^{-1} (rg = 0.806** and rp = 573**), number of seeds umbel^{-1} (rg = 667** and rp = 0.569**) and umbel diameter (rg = 851** and rp = 0.703**) both at the genotypic and phenotypic levels. Thus, the data revealed that the highest positive correlation (0.932) was appeared between number of umbels plant^{-1} and seeds yield (gm) whereas the lowest positive correlation (0.031) was expressed between number of umbellets plant^{-1} and 1000-seeds weight. Hence, the study will help the breeder to know the degree of association between traits, which can be used for crop improvement through selection of component traits.**

Key words: Genotypic correlations, phenotypic correlations, selection and coriander.

Most of the agronomic characters in crop plants are quantitative in nature. Yield is one such character that results due to the actions and interactions of various component characters (4). It is also widely recognised that genetic architecture of yield can be resolved better by studying its component characters. This enables the plant breeder to breed for high yielding genotypes with desired combinations of traits. However, genotypic and phenotypic correlations are of value to indicate the degree to which various morpho-physiological characters are associated with economic productivity. Therefore, the present studies were initiated to investigate the interrelationship of yield components and the type and extent of their contribution to yield. The information so derived could be exploited in devising further breeding strategies and selection procedures to develop new varieties of coriander capable of high productivity.

Coriander (*Coriandrum sativum* L.) is an annual spice herb that belongs to the family Umbelliferae /Apiaceae (6). Coriander is a diploid cross pollinated crop. It is a native of Mediterranean and near eastern region and is cultivated in Argentina, Burma, England, France, Holland, India, Italy, Mexico, Morocco, Pakistan, Rumania, Spain, Turkey, USA, USSR and Yugoslavia. The coriander seed are used as spices in the preparation of curry powder and pickling spice. They are used for flavouring pastry, cookies-cakes, tobacco, bakery product, meat fish, soda, syrups, candy, preserve and liquor (15). They are also used as a condiment in the preparation of sausages, seasonings and cookies, and as a flavoring for alcoholic beverages (2). Coriander is a good melliferous plant and studies indicated that one hectare of coriander allows honey bees to collect about 500 kg of honey (11). The seed contains significant quantities of carotene, thiamine, riboflavin, niacin, tryptophase, vitamin B6, folate, vitamin C and E (7); iron, manganese, magnesium and dietary fiber to the diet (3).

MATERIALS AND METHODS

In the present investigation, an experiment consist of 9 elite germplasm lines of Coriander (*Coriandrum sativum* L.) namely 2007, 8918, 2002, 9903, 9106, 9807, 2015, 2108 (germplasm lines) including check variety Azad Dhania-1 obtained from; diverse eco-geographical regions of India and abroad, and the collection maintained at Vegetable Farm, Department of Vegetable Science, Kalyanpur, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. The materials were evaluated in an augmented Randomized Block Design with three replications during the *rabi* season of 2009-10. The climate of Kanpur region is typically semi-humid and sub-tropical with extreme winter and summer. The average rainfall is 800 to 850 mm. which is mostly from June- September. The maximum temperature is in month of April-May which range from 30.1-41.71° C and minimum temperature found in November-January ranging from 4.4 to 10.0° C.

Observations were recorded for 11 characters viz., plant height (cm), days to 50% flowering, days to maturity, number of primary branches plant^{-1}, number of secondary branches plant^{-1}, number of umbels plant^{-1}, number of umbellets umbel^{-1}, number of seeds umbel^{-1}, umbel diameter (cm), test weight (gm), and seed yield plant^{-1} (gm). Variances were worked out to test the significance of differences in treatment mean followed by 'F' and 't' tests. It was carried out according to (10). Thus, all possible correlation coefficient among 11 characters were calculated at genotypic and phenotypic level following the procedure (9). This was computed in terms of genotypic and phenotypic correlation coefficient based on variance and covariance. The phenotypic correlations were tested from the table (14) at 5 and 1 per cent level of significance at n-2 d.f.

RESULTS AND DISCUSSION

Yield plant^{-1} in coriander is the result of interaction of number of inter-related characters. Therefore, selection should be based on these components characters after assessing their correlation with yield plant^{-1}. In the present study, the value of correlation at phenotypic level were higher than the genotypic correlation indicating that there is strong inherent association between the various characters studied. The analysis of variance revealed highly significant differences among the genotypes for all the characters studied in the present investigation (Table 1 and 2). Genotypic and phenotypic correlation coefficients provide a quantitative evaluation of effects of environments on particular character. The association of grain yield with other characters was estimated by genotypic and phenotypic correlation coefficients (Table 3). Seed yield is positively associated with several characters such as plant height, number of primary branches plant^{-1}, number of secondary branches plant^{-1}, number of umbel plant^{-1}, number of umbellet umbel^{-1}, number of seed umbel^{-1} and umbel diameter. The results obtained in this present study were in agreement with the findings of (1,5,8,12,13).

Table -1: ANOVA table for 11 characters in coriander

Source of variance	d.f.	Plant height (cm)	Days to flowering	Days to maturity	Number of primary branches per plant	Number of secondary branches Per plant	Number of umbels per plant	Number of umbellets per umbel	Number of seeds per umbel	Umbel diameter (cm)	Test weight (1000 seeds)	Seed yield (gm)
Replication	2	0.703	0.875	0.187	0.212	0.718	0.453	0.357	0.789	0.304	0.109	0.750
Treatment	8	200.453**	16.323**	10.436**	3.240*	1.968	19.002**	13.909**	29.268**	9.190**	5.783**	11.398**
Error	16	4.787	0.693	0.669	0.842	0.0389	1.006	0.165	0.188	0.504	0.0291	0.847

* Significant at 5% level of significance

** Significant at 1% level of significance

Table -2: Grand mean range of 11 characters in coriander

S. No.	Character	Mean (X)	Range		CV %	Critical difference between to mean (CD) at 5%
			Minimum	Maximum		
1	Plant height (cm)	116.297	106.00	124.00	1.8814	0.379
2	Days to flowering	77.740	73.00	80.00	1.6924	0.228
3	Days to maturity	140.481	139.33	142.33	0.6483	1.576
4	Number of primary branches per plant	11.559	9.27	13.93	6.3167	1.264
5	Number of secondary branches per plant	27.651	25.07	30.47	3.7325	1.748
6	Number of umbels per plant	66.748	45.67	80.40	4.9155	0.568
7	Number of umbellets per umbel	8.874	7.33	10.80	9.2341	1.418
8	Number of seeds per umbel	34.881	29.20	37.60	3.7199	0.225
9	Umbel diameter (cm)	18.392	17.60	19.80	4.7396	1.509
10	Test weight (1000 seeds)	10.840	9.78	11.78	6.1935	1.162
11	Seed yield (gm)	27.699	24.82	30.43	2.9222	1.401

Seed yield which obtained negative associated were days to flowering, days to maturity and 1000 seeds weight. Thus, it revealed that seed yield was negative non-significant with traits days to maturity at phenotypic level and 1000 seeds weight showed non-significant both at the phenotypic and genotypic levels. On the other hand, a negative non-significant association between 1000 seeds weight and seed yield per plant at genotypic level was also obtained. Therefore, while making a program for improvement of coriander through selection these traits may be taken into consideration. On the other hand, the highest positive correlation of 0.932 was appeared between number of umbels plant^{-1} and seeds yield (gm) whereas the lowest positive correlation of 0.031 was expressed between number of umbellets plant^{-1}and 1000-seeds weight. Genotypic and phenotypic correlation co-efficient effects estimated for various traits in coriander (Table 3) indicated higher magnitude of genotypic correlations than phenotypic correlations.

CONCLUSION

Thus, based on the association analysis, the characters plant height, number of primary branches plant^{-1}, number of secondary branches plant^{-1}, number of umbel plant^{-1}, number of umbellet umbel^{-1}, number of seed umbel^{-1} and umbel diameter will help the breeder to know the degree of association between traits. In spite of that, these traits had significant and positive correlations with seed yield. Hence, it could be suggested that such traits among investigated characters are good phenotypic selection indices to improve seed yield in coriander.

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Annals of Horticulture 4(2) : 193-196(2011) Hi-Tech Horticultural Society

MULTIPLE SHOOT INDUCTION FROM THE SHOOT TIP EXPLANTS OF *CUCURBITA MAXIMA*

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ABSTRACT

The present study was carried out to study the effect of different phytohormones on rate of multiplication of *Cucurbita maxima* during *in vitro* micropropagation. Shoot tip explants were cultured on Murashige and Skoog (MS) medium supplemented with different BAP, Kinetin and NAA at various levels of concentration and their combination for shoot proliferation. The proliferation rate, shoot quality and other parameters studied indicate that the optimal treatment was 2 mg/l BAP. Shoots were rooted most effectively in half strength MS medium supplemented with 5mg/l NAA. Rooted plants were hardened and successfully established in soil with 90% survival rate.

Key words: *Cucurbita maxima,* shoot tip explant, shoot proliferation

The family Cucurbitaceae, which consists of 2 subfamilies, Cucurbitoideae and Zanonioideae, is moderately large, consisting of about 130 genera and 900 species (5). The species are distributed primarily in the warmer areas of the world, especially in the tropics and subtropics. They are less frequent in temperate regions because of their frost sensitivity (8). This is a cross pollinated plant. So it can not produce sufficient hybrid seeds because large scale emasculation is not possible. Conventional breeding methods are most widely used for crop improvement, but there have some potential limitations (1). Some of genetic potential is not available due to sexual incompatibility barriers appearing in intergeneric and interspecific levels as observed in several crops(3). The techniques of plant tissue culture and genetic manipulation are useful to solve those problems (7). Recent developments in biotechnology have opened up several ways for the crop breeding using transformation in which heterologous genes can be introduced into exiting cultivars. In comparison with cucumber (*Cucumis sativus*) (7) and watermelon (*Citrullus vulgaris*) (4,2), less attention still has been given to tissue culture of *Cucurbita* species. The present study was carried out to study the effect of different concentration and combination of BAP, Kinetin and NAA on shoot multiplication of *Cucurbita maxima.*

MATERIAL & METHODS:-

Shoot tips from field grown plants were excised and used as explants. The explants were washed under running tap water for 15 minutes followed by 10 minutes rinsing with Tween20. After washing with water several times, the explants were surface sterilized with 0.1% mercuric chloride for 7 minutes followed by three times washing with sterile distilled water in a laminar air flow chamber. The explants were inoculated on MS medium containing 3% sucrose with different concentrations and combinations of BAP, Kinetin and NAA. The pH of all the media was adjusted 5.8 before autoclaving at 121° C for 20 minutes. The cultures were kept at 25±2° C with a 16 h photoperiod under diffused cool white fluorescent light. Individual shoots were carefully excised from the shoot clusters arising from the explants and subcultured on media containing the same hormone composition. After multiple shoot formation, the plantlets were transferred to rooting media containing NAA. Rooted plantlets were transferred in soil for hardening.

RESULT & DISCUSSION:-

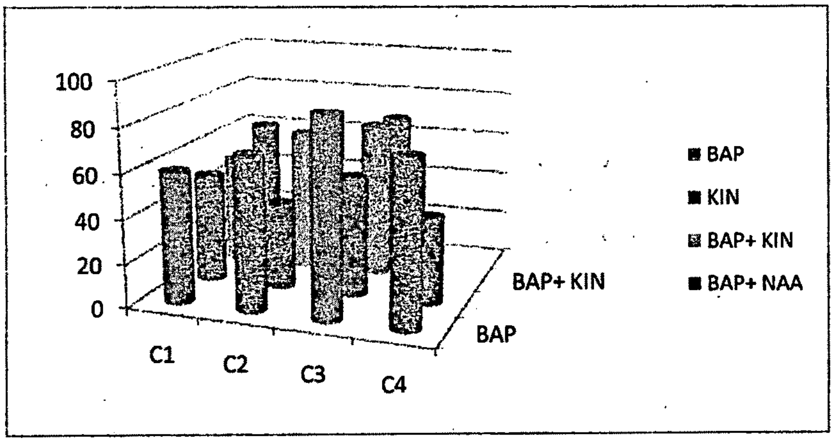
The present study was carried out to study the effect of different concentration and combination of BAP, Kinetin and NAA on shoot multiplication of Cucurbita maxima. In the present study among all the combination and concentration, the longest shoots (6.2 cm) and the highest percentage of shoot formation (90%) were observed in the treatment with 2.0mg/l BAP after 25 days of culture and the highest number of shoots per shoot tip (14.2) was noted in the same media. Results also showed that single use of BAP is more effective than combination treatment with Kinetin and NAA. Between BAP and Kinetin effect of BAP was greater in producing higher number of shoots. Highest frequency of root formation with maximum number of roots per shoot could be recorded in presence of 5.0 mg/l NAA followed by 3.0mg/l, higher concentration above than 5.0mg/l reduced in number of roots per shoot.

Table 1. Effect of BAP, Kinetin and NAA on multiple shoot induction from the shoot tip explants of *Cucurbita maxima*

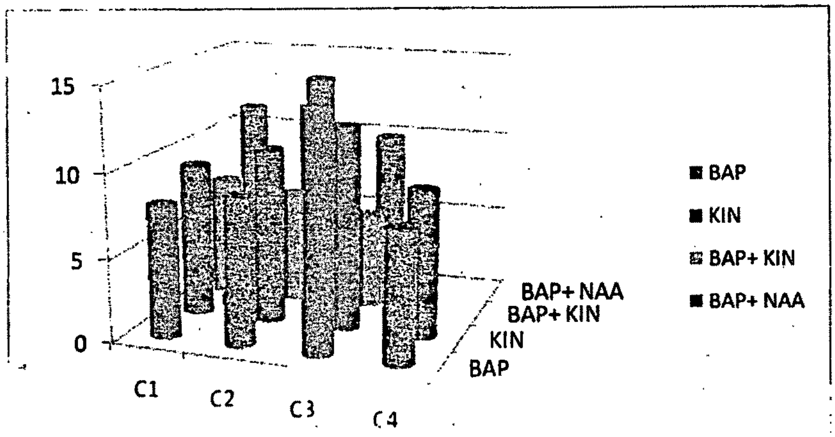
PGR (mg/l)		Explants induced multiple shoots (%)	Mean No. of shoots per culture	Mean length of longest Shoot (cm)
BAP	1.0 (C1)	60	8.0	5.2
	1.5 (C2)	70	8.9	5.3
	2.0 (C3)	90	14.2	6.2
	3.0 (C4)	75	7.9	4.8
KIN	1.0 (C1)	50	9.3	4.2
	1.5 (C2)	40	10.6	4.6
	2.0 (C3)	55	12.3	5.6
	3.0 (C4)	40	8.9	3.8
BAP+ KIN	0.5 + 0.5(C1)	50	7.3	5.3
	1.0 + 0.5(C2)	65	6.8	5.8
	1.0 + 1.0(C3)	71	5.8	6.0
BAP+ NAA	0.5 + 0.5(C1)	60	11.2	5.8
	1.0 + 0.5(C2)	65	13.3	4.6
	1.0 + 1.0(C3)	68	9.8	4.9

Table 2. Effect of NAA on root induction from the shoot tip explants of Cucurbita maxima

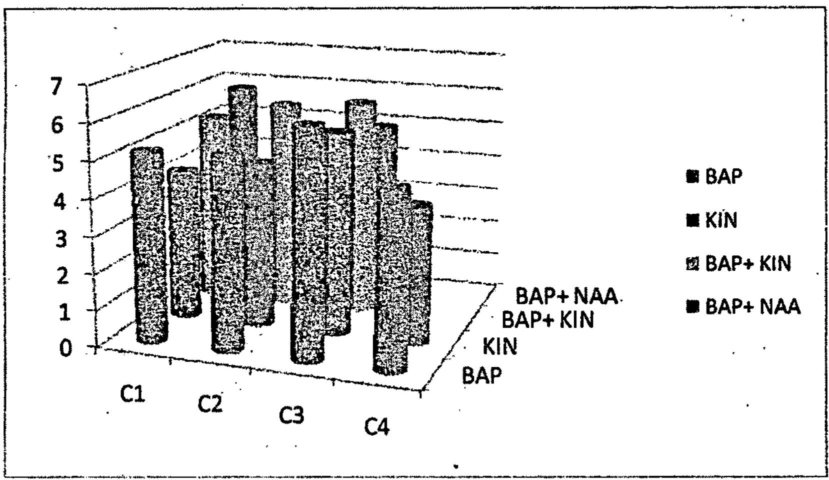
PGR (mg/l)		Explants induced multiple roots (%)	Mean No. of roots per culture	Mean length of longest root (cm)
NAA	1	50	8.3	5.8
	2	70	10.2	6.6
	3	72	10.5	6.8
	5	79	12.2	7.2
	7	65	9.2	6.0



Effect of BAP, Kinetin and NAA on -Explants induced multiple shoots (%)



Effect of BAP, Kinetin and NAA on- Number of shoots per culture



Effect of BAP, Kinetin and NAA on- length of Shoot (cm)

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EFFICACY OF BIO FERTILIZERS IN POTATO (*SOLANUM TUBEROSUM L*)

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Key words : Tuber, Bio fertilizer, Dry matter, Azotobactor, Phospho-bactieria, Bacillus subtilis

Potato (Solanum tuberosum L.) is one of the important food crop. The potato produce more carbohydrate, fiber and vitamins per unit area and per unit time than other major food crops (Shekhawat and Dahiya, 2000). Potato is used as vegetable alone and mixed with other vegetables.

The potato is heavy feeder of fertilizers and needs large quantities of chemical fertilizers. The cost of chemical fertilizers have enormously gone up, it is necessary to examine alternative, cheaper and easily available nutrients source, therefore, bio fertilizers have been recognized as cheapest fertilizers input for developing countries like India, as a source of supplement to the application of chemical fertilizers for better crop production . Among the chemical fertilizers, nitrogen found in atmosphere approximately 78% in utilized form so these nitrogen may converted in to available form through bio fixation. Among micro-organisms, Azotobacter has play important role to supplementary nitrogen to crops, phosphorus also important nutrient for plants, however, Indian soil test generally low to medium in available phosphorus and not more than 30% of applied phosphate is available to current crop, remaining parts gets converted into relatively unavailable form. Bhattacharya et. Al., (2000) reported than around 95.99% of total soil phosphorus is insoluble which are not directly available to plants, several bacteria's such as Bacillus/Aspergillus and Phosphobactiria convert P into soluble form.

The field experiment was conducted during winter season at research farm of Shri F.H. (P.G) College, Nidhauli Kalan, Etah in Uttar predesh (27^0 2' north latitude, 72^0 9' east latitude at 175.13m above mean sea level). The soil of experimental field was sandy loam with organic carbon 0.27 percent. The soil has 210.60 kg/ha available N, 22.4kg/ha Olson'P and 176.3 kg/ha available K. The experiment was lead out in randomized block design with factoria concept and each treatment four times thes were ten treatment combinations, involving tw fertility levels and five bio fertilizer treatments. Each treatment combination allocated randomly in each plot of block. The treatment comprised two fertility levels 100% N (150 kg/ha) and P (80 kg/ha) and phosphorus (60 kg/ha) and bio fertility treatments (Control, Soaking tuber in solutions of 1% each of urea and Sodium carbonate, T_2 + bio fertilizer, bacillus cereus (treatment of tuber before planting) and bacillus subtilis (treatment of tuber before planting). The recommended dose of fertilizers N,P,K (150, 80, 100 kg/ha) was applied as per treatment at the last ploughing. The whole quantity of FYM @ 20 tones/ha incorporated in the soil, half quantity of N, full quantity of phosphorus and potassium were applied in row about 45 cm away from seed tubers and remaining quantity of N was applied at the time of earthling in the form of top dressing in furrow. In the tuber treatments with bio fertilizers, T_1 (control) no treatment to seed tuber, in T_2 200g each of Urea and sodium bicarbonate were dissolved in 20 liters of water (each of 1%) and the well sprouted healthy seed tubers of potato were soaked in this solution for 5 minutes, this solution was sufficient for 50kg of tubers, in T_3 treatments, T_2 (whole procedure some as T_2 treatments) with treated to Azotobactor and phosphobecteria, the jaggery solution was prepared by dissolving 100g of jaggery in one liter of water and 200g each of azotobacter and Phosphobacteria were added to this solution. The solution was spread on the tuber and was mixed thoroughly with hands to obtained uniform coating. In T_4 treatments, ½ kg culture of Bacillus (strain M_1) was suspended in 40 liter and a slurry was prepared by boiling of 2 kg of Jaggery in one liter of water, the tuber were dipped in this solution for 30 minutes and than tuber were taken out from solution and spread for drying in T_5 treatments, Bacillus subtilis (strain B_5) solution prepared and tuber treated (Proceduresome like T_4 treatements) with it. The treated seed tuber of potato were planted in prepared plots on 9th November during the year of 2005-06. The tuber were planted on the surface of plot at the spacing of 60x20 cm. The crop was harvested on 9th feb. during 2005-06. The data were analysed by method of "analysis of variance" and treatments were compared with help of CD (4).

The application of 1% urea and Sodium carbonate + Azotobacteria + Phosphobacteria (T_3) showed the significant result for growth attributes (Table-$_1$). The maximum emergence present at 30 days was recorded (90.89%) in T_3 treatments and the combined effect of F x T on emergence highest in F_1 T_3 treatments combination (87.85%) and this treatments found to at par with the other treatment combination. The number of stems per plot at 30 days fertility levels F_1 recorded maximum number of stems (367.13 per plot) than F_2 fertility levels and treatments T_3 recorded maximum number of stems (398.3 per plot) and found significant than other bio fertilizer treatments (Frommel et al. 1993). The interaction of F x T show maximum number of stems (417 per plot) under the treatment combination F_1 T_3 than other combination (Table-1). The plot height at 30 and 60 days significantly increased in F_1 fertility levels (23.91 cm. and 33.85 cm.) than F_2 levels and bio fertilizer treatments show highest (Table 1) plant height (26.90 cm. and 39.50 cm.) at 30 and 60 days under the treatment combination F_1 T_3 other combination.

The yield of tuber per hill significantly increased under fertility F_1 as comparison to F_2 fertility levels and bio fertilizer treatment T_3 show highest total yield per hill (549.89 gram/hill) than other treatments. Total number of tuber per plot also maximum recorded under the fertility level F_1 and bio fertilizer treatment T_3 as compare to other (Table -2). Total tuber yield obtained maximum under fertility level F_1 (285.37 g/ha) and bio fertilizer treatment T_3 (316.28 q/ha) as compare to other treatment, Sunaina et. al. (2001), Singh (1990) and Belunger et a! (2000). Sood and Sharma (2001) reported that Bacillus circus (A) and Bacillus subtilis (B) separately increased the tuber yield of potato from 155 to 268 q/ha and was at par with 100 percent NPK treatment. The dry matter content of tuber showed significant result under the fertility levels F_2 (22.27%) than F_1 and under T_1 bio fertilizer treatment (22.22%). The interaction effect of fertility levels and bio fertilizer treatment showed maximum (Table-2) under the combination F_1 T_3 in total yield of tuber per hill (570.82 g/hill), total tuber yield (343.98 q/ha) and in dry matter content of tuber (27.04%) under the combination F_2T_1 respectively.

Summary

A field experiment was conduct during winter season of 2005-06 at Shri F. H. (PG) College Nidhauli Kalan, Etah to study the efficacy of biofertilizer with different fertility level on growth, yield and quality parameter of potato (Solanum tuberosum L.) The analysis showed that the emergence percentage, plant height at 30 days and 60 days, no. of stems per plot showed significant result under F_1 fertility level, T_3 bio fertilizer treatment and F_1T_3 combination. The total yield of tuber / hill, no. of tuber per plot, total yield (q/ha.) significantly increased due to F_1 fertility level and T_3 biofertilizer treatment and with F_1T_3 combination, while, maximum dry matter content (%) in tuber found in F_2 fertility level and T_1 treatment and under the F_2 T_1 combination.

Table-1: Effect of fertility level and biofertilitilizer treatment on the growth attributes of patoto (Solonum tuberosum L.)

Biofertilizer Treatment	Emergence (%) at 30 days			No. of stems per plant at 30 days			Plant height (cm) at 30 days			Plant height (cm) at 60 days		
	Fertility level											
	F_1	F_2	Mean	F_1	F_2	Mean	F_1	F_2	Mean	F_1	F_2	Mean
T_1	82.50	82.58	82.54	320.00	242.33	281.16	24.65	21.23	22.94	32.63	28.43	30.53
T_2	88.04	86.50	87.27	346.66	300.00	323.23	25.41	20.60	23.00	35.15	31.20	33.17
T_3	93.13	88.66	90.89	417.00	379.66	398.33	26.90	23.80	24.35	39.50	32.83	36.16
T_4	86.21	85.65	85.93	409.00	292.66	350.83	23.70	23.00	23.35	32.80	28.96	30.88
T_5	84.18	80.66	82.42	343.00	296.66	319.83	22.83	18.90	20.86	29.66	28.20	28.93
Mean	87.01	84.81	NS	367.13	302.26	NS	23.91	22.31	NS	33.85	29.92	NS
		SEM+_	CD at 5% (P=0.53)		SEM+_	CD at 5% (P=0..5)		SEM+_	CD at 5% (P=0.05)		SEM+_	CD at 5% (P=0.05)
Fertility level (F)		1.66	NS		7.16	21.28		0.44	1.30		0.53	1.59
Biofertilizer Treatment (T)		2.63	7.82		11.32	33.65		0.69	2.06		0.85	2.52
FXT		3.72	11.06		16.01	47.59		0.98	2.92		1.20	2.10

Table-2 Effect of fertility levels and bio fertilizer on the yield attribution and dry matter of potato (Solanum tuberosum L.).

	Fertility level (F1 and F2)											
Bio fertilizer Treatment	Total yield of Tuber (g) per hill			Total no. of tuber per plot			Total tuber yield (g/ha)			Dry matter (%) content of tuber		
	F_1	F_2	Mean	F_1	F_2	Mean	F_1	F_2	Mean	F_1	F_2	Mean
T_1	399.95	384.02	391.98	70.	712	708	244.44	234.64	239.54	21.4	27.04	22.22
T_2	413.95	402.77	408.36	797	678	738	277.08	236.11	256.59	20.85	20.76	20.80
T_3	570.82	528.96	549.89	848	791	819	343.98	288.58	316.28	20.80	20.25	20.53
T_4	483.00	419.17	451.08	846	730	788	299.76	252.39	276.08	88.8 8	21.76	20.31
T_5	483.00	419.00	451.08	711	750	731	261.57	245.13	253.35	19.18	21.57	20.37
Mean	473062	441.62	NS	781	732	NS	285.37	251.37	NS	20.33	22.27	NS
		SEM+_	CD at 5%	SEM+_		CD at 5%	SEM+_		CD at 5%	SEM+_		CD at 5%
Fertility level (F)		0.39	0.83	1.34		2.83	0.39		0.83	0.23		0.70
Bio fertilizer treatment (T)		0.62	1.31	2.13		4.48	0.62		1.31	0.37		1.11
FXT		0.88	1.86	3.01		6.34	0.88		1.86	0.53		1.57

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STUDIES ON EFFECT OF BIOFERTILIZERS WITH CHEMICAL FERTILIZERS ON GROWTH AND YIELD OF CAULIFLOWER (*BRASSICA OLERACEA* VAR. *BOTRYTIS*) CV. PUSA SNOWBALL K-1

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Key words: Biofertilizer, fertilizer, growth, yield, cauliflower.

Cauliflower (*Brassica oleracea* var. *botrytis*) is one of most important winter vegetables in India and belongs to family Brassicaceae. It is herbaceous annual vegetables grown for its white tender 'curd' and biennial for seed production. It is used as vegetable in curries, soup and for pickles. Among different vegetables, cauliflower fairly nutritious and it contains 90.8% moisture, 2.6 protein, vitamin A 51 IU, 0.04% thiamine, 1.0 mg nicotinic acid, vitamin 56 mg, Ca 33 mg/100g of edible protein. Besides, possessing several medicinal properties, it is believed to alleviate diarrhoea, stomach trouble, headache and cancer, because of these qualities, cauliflower deserves an honourable place in Indian agriculture and needs rapid expansion of cultivation. India is the largest producer in the world.

Cauliflower is heavy feeder and it requires amount of nutrient like nitrogen, phosphorous and potassium. India has been spending billions of dollers every year for the import of chemical fertilizers, insecticides and pesticides. The uses of various combinations of chemicals in agriculture have shown many irreversible impact on the environmental pollution, human health and soil health hazards. So, there is a need to seek some alternative sources of nutrient. Besides, these increasing cost of nitrogenous and phosphatic fertilizers is also another factor to be reckonened with for a developing country like India. In recent years, uses of microbial inoculants as a source of biofertilizers have become a hope for environmental points of view are concerned. Biofertilizers are economically attractive and ecologically sound means of fertilization. Therefore, in developing countries like India, it can solve the problem of high cost fertilizers and help in saving the economy of the country.

The experiment included nine treatment combinations viz. T_1 (Recommended dose of NPK i.e. 120:60:60Kg/ha without biofertilizers), T_2 (*Azospirillium*+75% N+ recommended dose of PK), T_3 (*Azospirillum* + recommended dose of NPK through chemical fertilizers), T_4 (Azotobacter+75%N and recommended dose of PK), T_5 (*Azotobacter* +recommended dose of NPK through chemical fertilizers), T_6(PSB+75% P and recommended dose of N K), T_7 (PSB +75% P and recommended dose of NK through chemical fertilizers), T_8 (VAM+75% P and recommended dose of NK) and T_9 (VAM+ recommended dose of NPK). The experiment was carried out in Randomized Block Design with three replications at Horticulture Research Farm, Department of Applied Plant Science (Horticulture), Babasaheb Bhimrao Ambedkar University (A Central University), Vidya Vihar, Rae Bareli Road, Lucknow-226 025 (UP), India during rabi 2007-08. Row to row spacing were maintained at 60 x50cm, respectively. All the agronomic package of practices were adapted to grow a healthy crop in each replication.

Observation were recorded on five randomly selected plants for characters viz. plant height (cm), number of leaves/plant, leaf length (cm), leaf width (cm), leaf weight(g), stem diameter(cm), curd diameter (cm), gross weight of plant(kg), net weight of curd (kg) and yield(q/ha).

Data from table-1 revealed that the differences with respect to the plant height were significant among different treatment combinations at various stages of crop growth. The maximum plant height (53.16cm) was recorded at 45 days after transplanting under treatment T_7 (PSB+ Recommended dose of NPK) followed by treatment T_6 (PSB+75%P and recommended dose of N K), which was statistically at par with treatment T_5 (*Azotobacter*+ recommended dose of NPK). The minimum plant height was recorded under the treatmentT_1 (recommended dose of NPK) followed by treatmentT_3 (Azospirillum+ recommended dose of NPK). The treatment T_7 was found significantly superior than treatment T_1 (control) and also compared to other treatment combinations. At 75 days after transplanting maximum plant height (55.99cm) was also observed under the treatment T_7 (PSB+ recommended dose of NPK) and it was statistically at par with treatment T_6 (55.98cm) and treatment T_3 (Azospirillium + recommended dose of NPK) showed the minimum plant height (46.13cm) followed by treatment T_4 (Azotobactor+75% N and recommended dose of PK). At 90 days after planting treatment T_7 (PSB+ recommended dose of NPK) was to be found effective for plant height (66.89cm), which was highly significant over to control T_1 (57.99cm) and also over other treatment combinations. The minimum plant height was showed in treatment T_3 (51.35cm) and treatment T_4 (Azotobactor+75% N and recommended dose of PK) 52.81cm.

The maximum leaf length (48.91cm), maximum leaf width (20.03cm) and maximum leaf weight/plant (2.190Kg) was recorded under treatment T_7 (PSB+ recommended dose of NPK) and was significantly superior over all the treatment and also over control. At 45 days after transplanting maximum stem diameter (1.98cm) was recorded under the treatmentT_7 (PSB +recommended dose of NPK) followed by treatment T_6 (1.51cm, PSB+75% P and recommended dose of NK). However, these treatments were at par with other treatment except T_1, T_9, T_5 and T_8. The minimum stem diameter was recorded under the treatment T_2 (Azospirillum+75%and recommended dose of PK). The maximum stem diameter at 75 days after transplanting under treatment T_1 and T_4 treatments. None of these treatments influenced significantly stem diameter over the control. At 90 days after transplanting treatment T_7 (PSB+ recommended dose of NPK) showed the maximum stem diameter (3.41cm), which was at par with treatment T_8 (VAM+75% recommended dose of NK) and was significantly superior over other treatments and as well as to control. Minimum stem diameter (3.02cm) was recorded in treatment T_2 (Azospirillum +75% recommended dose of PK). Curd diameter was not significantly affected by different combinations of biofertilizers. However, treatment T_7 (PSB+ recommended dose of NPK) showed maximum (12.47cm) curd diameter followed by treatment T_8 (12.36cm, VAM+75%P and recommended dose of NK), While least diameter of curd was showed by treatment T_1 (10.39cm).

The maximum gross weight of plant (3.590Kg) was recorded under the treatment T_7 (PSB+ recommended dose of NPK) followed by the treatment T_6 (3.540, PSB+75%P and recommended dose of NK) have shown

Table-1: Effect of different treatment combinations on plant height, no. of leaves, length of the leaves, width of leaves, leaf weight/plant, stem diameter(cm), curd diameter (cm), gross wt. of plant(kg), net wt. of curd(kg) and net curd yield(q/ha)

Treatments	Plant height (cm)			No. of leaves			Leaf length (cm)	Leaf width (cm)	Leaf weight /plant	Stem diameter (cm)			Curd Diameter (cm)	Gross wt. of plant (kg)	Net weight of curd (kg)	Net curd yield (q /ha)
	45 DAT	75 DAT	90 DAT	45 DAT	75 DAT	90 DAT				45 DAT	75 DAT	90 DAT				
T_1	43.30	51.34	57.99	8.52	11.58	15.17	42.14	15.59	1.47	1.19	2.91	3.17	10.39	2.05	0.700	271.50
T_2	49.15	52.29	54.26	9.19	10.43	16.16	41.98	18.30	1.71	1.06	2.83	3.02	11.21	2.58	0.793	305.43
T_3	43.73	46.13	51.35	9.56	10.56	15.75	38.32	18.81	1.64	1.32	2.81	3.03	11.46	2.91	0.936	396.56
T_4	46.94	49.90	52.92	9.20	10.42	14.80	33.14	17.05	1.85	1.20	2.91	3.10	10.82	2.96	0.956	286.16
T_5	52.29	54.97	56.92	8.98	10.09	16.61	40.99	18.34	1.66	1.38	2.84	3.11	10.79	2.85	0.957	330.59
T_6	52.47	55.98	59.86	8.96	12.12	17.22	43.32	17.10	2.10	1.51	2.81	3.34	11.26	3.54	0.973	359.76
T_7	53.16	55.99	66.39	10.45	11.62	17.16	48.91	20.03	2.19	1.98	2.86	3.41	12.47	3.59	0.980	385.11
T_8	50.23	54.37	60.05	9.11	10..34	17.16	41.26	17.67	1.70	1.12	2.81	2.27	12.36	2.96	0.968	376.82
T_9	49.77	52.78	54.99	9.66	11.27	11.27	42.69	18.94	2.00	1.03	2.84	3.20	12.14	3.25	0.958	337.04
CD at 5%	0.358	0.048	0.051	0.369	0.156	0.091	0.081	1.316	0.079	0.060	0.053	0.088	0.330	0.084	0.032	7.887

significant effect on gross weight of plant over all treatment and as well as over control. The minimum gross weight of plant (2.580Kg) was recorded under the treatment T_2 (Azospirillum +75%N and recommended dose of PK). The maximum net weight of curd/plant (0.980Kg) was recorded under the treatment T_7 (PSB+ recommended dose of NPK) was significantly superior over all treatments and as well as over control. The maximum curd yield/ha (385.11q/ha) was recorded under treatment T_7 (PSB+ recommended dose of NPK) was significantly superior over all the treatments and as well as also over control. The minimum curd yield (271.50Kg) was found in control (T_1).

On the basis of the above findings, it can concluded that the application of PSB + recommended dose of (120:60:60 Kg/ha) of NPK was proved best for higher curd yield. It means treatments T_7 was the best treatment of investigation.

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IMPACT OF K.V.K. TRAINING PROGRAMMES ON IMPROVEMENT IN SKILL OF TRAINED TRAINEES WITH RESPECT TO HORTICULTURE AND AGRONOMICAL PACKAGES AND PRACTICES

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Key Words: KVK,KVK Personnel, trained trainees, innovation and skills.

A skill training is defined as an action – oriented way of training in which the activity is performed. It deals with "what-to-do" and "how-to-do". Thus skill training may be considered as detailed step of illustration of performance of a component related to the job by involving the process of doing and practicing for behaviour changes of the workers.

The different categories of personnel from top the grass root level need different types of skills. Such skills are broadly divided into technical, communication and managerial skills. The managerial skills include supervision technical, communication and managerial skills. The communication skills include inter-personal, group and mass communication, preparation and presentation of extension talks and skills demonstration. The technical skills are the skills with are required by the farmers to perform the farm operations right from the preparation to harvest & post harvesting Techniques in agriculture, live stock management and allied area for increasing productivity and income. Keeping in view the present study was carried out with the objective to study the impact of Krishi Vigyan Kendra training programmes on improvement in skills of trainees with respect to horticulture and agronomical package of practices.

This study was conducted in Rampur district During the year 2007-08. Rampur district comprises of six blocks out of which four blocks were selected randomly. Then three villages from each block were selected randomly and ten trained trainees were selected purposively from each village. Thus the total sample size was 120. The data were collected through personal interview with the help of pre-structural schedule. The data were analyzed with the help of frequency, percentage and chi-square test.

Parameter a in table 1, reveals that the majority of trained (65.00 per cent) were found to have unskilled about potato crop production practices followed by 21.67 per cent trained trainees were have fully skilled about potato crop production practices and the remaining 13.33 per cent trained trainees has partial skilled about potato crop production practices.

Parameter b in table 1, presented data on skills of tomato crop that the majority of trained trainees (80.83 per cent) were found to have un skilled about tomato crop production practices followed by 10.83 per cent trained trainees were have fully skilled about tomato crop production practices and the remaining 8.34 per cent trained has partial skilled about tomato crop production practices.

Parameter c in table 1, reveals that the majority of trained (55.00 per cent) were found to have un skilled about chilli crop production practices, followed by 23.33 per cent trainees were have partial skilled about chilli crop production practices and the remaining 21.67 per cent trained trainees has fully skilled about chilli crop production practices.

Data on skills of capsicum crop presented in parameter d table 1, reveals that the majority of trained trainees (86.66 per cent) were found to have unskilled about capsicum crop production practices, while 6.67 per cent trained trainees has partial skilled about capsicum crop production practices.

Data on skills of vegetable pea crop presented in parameter e table 1, reveals that the majority of trained trainees (82.50 per cent) were found to have unskilled about vegetable pea crop production practices, followed by 10.00 per cent trained trainees were have fully skilled about vegetable pea crop production practices.

Data on skills papaya presented in parameter f table 1, reveals that the majority of trained trainees (90.00 per cent) were found to have unskilled about papaya production practices followed by 6.67 per cent trained trainees were have fully skilled about papaya production practice and the remaining 3.33 per cent trained has partial skilled about papaya production practice.

Table 1: Distribution of trained trainees on the basis of their skills with respect to vegetable & Fruit production package of practices.

Parameter	Skills	Frequency	Percentage	X^2 value
a) Potato	Fully skilled	26	21.67	55.40
	Partial skilled	16	13.33	
	Unskilled	78	65.00	
b) Tomato	Fully skilled	13	10.83	121.95
	Partial skilled	10	8.34	
	Unskilled	97	80.83	
c) Chlli	Fully skilled	26	21.67	25.40
	Partial skilled	28	23.33	
	Unskilled	66	55.00	
d) Capsicum	Fully skilled	8	6.67	53.60
	Partial skilled	8	6.67	
	Unskilled	104	86.66	
e) Vegetable pea	Fully skilled	12	10.00	130.65
	Partial skilled	9	7.50	
	Unskilled	99	82.50	
f) Papaya	Fully skilled	8	6.67	173.65
	Partial skilled	4	3.33	
	Unskilled	108	90.00	

Parameter a in table 2, reveals that the majority of (87.50 per cent) trained trainees wee found to have fully skilled about the wheat crop production practice and the remaining 12.50 per cent trained trainees has partial skilled about the wheat crop production practices. Similar finding were reported by (16) i.e. Positive contribution towards the impact of training on level of skill and helped the trained entrepreneurs to acquire more knowledge and skilled of the sophisticated improved dairy technology.

Parameter b in table 2, revels that the majority of trained trainees (63.33 per cent) were found to have unskilled about oil seeds and pulses crop production practices, whereas 22.50 per cent trained trainees were have partial skilled and the remaining 14.17 per cent trained trainees had fully skilled about oil seeds & pulses crop production practices.

Data on skills of mentha crop presented in parameter c table 2, reveals that the majority of trainees (65.00 per cent) were found to have fully skilled about mentha crop production practices, followed by 29.17 per cent trained trainees were have partial skilled and the remaining 5.83 per cent trained trainees has unskilled about mentha crop production practices. Parameter d in table 2, depicted that the majority of trained trainees (83.33 per cent) were found to have fully skilled about paddy crop production practices and the remaining 16.67 per cent trainees has partial skilled about paddy crop production practices.

Table 2: Distribution of trained trainees on the basis of their skills with respect to agronomical crop production package of practices.

Parameter	Skills	Frequency	Percentage	X^2 value
a) Wheat	Fully skilled	105	87.50	
	Partial skilled	15	12.5.	161.26
	Unskilled	00	00	
b) Oil seeds & Pulses	Fully skilled	17	14.17	
	Partial skilled	27	22.50	49.855
	Unskilled	76	63.33	
c)Mentha	Fully skilled	78	65.00	
	Partial skilled	35	29.17	63.95
	Unskilled	7	5.83	
d) Paddy	Fully skilled	100	83.33	
	Partial skilled	20	16.67	140
	Unskilled	00	00	
e) Sugarcane	Fully skilled	21	17.50	
	Partial skilled	18	15.00	59.15
	Unskilled	81	67.50	

Parameter e in table 2, presented that the majority of trained trainees (67.50 per cent) were found to have unskilled about sugarcane crop production practices, followed by 17.50 per cent trained trainees were have fully skilled about sugarcane crop production practices, and the remaining 15.00 per cent trained trainees and partial skilled about sugarcane crop production practices. All parameters calculated chi-squire values of significance which is significant. Similar findings were reported by (4).

It is concluded from the above study that most of the krishi vigyan Kendra trained trainees were found to have fully skilled about the wheat, mentha and paddy crop production package of practices, while majority of the trainees were found to unskilled about the oil seeds & pulses crops, sugarcane, potato, tomato, chilli, capsicum, vegetable pea and papaya production package of practices. The investigation refer to provide demonstration and skill oriented training to the farmer on package of practices of vegetable, fruit and food grain crop production for human resources development.

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STUDIES ON THE NUTRITIVE VALUE OF COMMERCIAL FRUITS

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Key words: Commercial fruits, Varieties, Nutritive value

India is the second largest producer of fruits in the world with an estimated production of about 46.5 million tones (6). Fruits contain protein, fat, carbohydrate, minerals mainly Ca, P, and Fe, vit. A, B_1, vit. B_2, vit. B_3, vit. C. These help in the maintenance of proper health and prevention of diseases. However, people are not aware of the nutritive value of fruits (4). The present investigation was, therefore, planned to assess the nutritive value of important fruits and their varieties grown in Northern India so that varieties richer in important such as sugar, vitamins, protein, pectin, fibre and minerals could be identifie.

The present experiment was conducted at the Department of Food Science and Nutrition, M.A.B. College of Home Science, C.S.A. University of Agriculture and Technology, Kanpur during the year 2003-04. A total number of 8 cultivars (Papaya-3, Orange-3 and Apple-2) were studies in a completely randomized design with three replications. Important varieties of fruits were collected from authentic sources. Composite samples of five fruits of each variety from each replication were taken out at random for their chemical analysis, T.S.S., total sugar, acidity, calcium, iron, pectin contents and acidity of the pulp/juice were recorded by using standard estimation techniques (1). Ascorbic acid content was determined with 2, 6 dichlorophenol indophenol and expressed as ascorbic acid mg/100g of pulp.

The data on chemical compposituion of papaya, orange and apple and their commercial varieties are summarized in Table 1. Papaya fruits showed variation of 13.20^0 to 14.00^0 Brix in TSS with a mean 13.57^0. Brix and 11.50 to 12.60 per cent in total sugar content, respectively. In orange varieties, Kinnow excelled with 10.26^0 Brix and 6.49 per cent TSS and total sugar, respectively, followed by Nagpur Orange and Musambi. As regards apple, Golden Delicious revealed higher total sugar and TSS than Red Delicious. Similar variations in sugar and TSS content was

Table 1: Nutritive value of commercial varieties of fruits of Northern India

Fruit crop	Varieties	Total Sugar Contain (%)	T.S.S content (^{0}Brix)	Acidity (%)	Vitamin 'C' content (mg/100g fruit)	Pectin content (%)	Calcium content (%)	Iron content (%)
Papaya	Pusa Delicious	11.50	13.50	0.14	44.00	1.20	0.01	
	Pusa Giant	11.60	13.20	0.15	46.00	1.10	0.01	
	Surya	12.60	14.00	0.13	41.00	1.00	0.01	
	Mean	11.90	13.57	0.14	43.67	1.10	0.01	
Orange	Nagpur Orange	5.47	9.11	0.37	48.16	1.36	0.47	
	Musambi	4.63	7.61	0.32	56.11	1.20	0.35	
	Kinnow	6.49	10.26	0.68	32.89	1.10	0.42	
	Mean	5.53	9.00	0.45	454.72	1.22	0.41	
Apple	Red Delicious	9.80	12.90	0.56	54.20	1.40	0.01	
	Golden Delicious	10.40	12.39	0.52	57.60	1.50	0.01	
	Mean	10.10	12.60	0.54	55.90	1.45	0.01	
	C.D.(P=0.05)	2.269	2.213	0.059	11.460	0.140	0.003	

observed by different workers in papaya (6,7), citrus (3) and apple (5).

Vitamin C and acid content studies in fruits revealed that apple was comparatively richer in vitamin C and acid content followed by orange. However, papaya expressed lower values in both the ingredients. As regards the varietal performance, Pusa Giant cultivar of papaya excelled in vitamin C and acidity, containing 46 mg/100 g fruit and 0.15 per cent values, respectively, followed by Pusa Delicious and Surya. Among orange Musambi expressed the maximum vitamin C content followed by Nagpur Orange. Kinnow orange on the other hand proved relatively a rich source of acidity. Red Delicious and Golden Delicious gave 54.2 and 57.60 mg vitamin C and 0.56 and 0.52 per cent acid content in the fruits, respectively. These findings are in line with the observation of other workers in papaya (3,6), citrus (2) and apple (5).

Among the three fruits apple emerged to be the fair source of pectin followed by orange while papaya was the poorest. Golden Delicious variety of apple appeared relatively superior in this respect. Previous finding (9) support the present results.

Mineral elements from an group of nutrients necessary for the maintenance and growth of the body. In the present investigation orange showed maximum calcium content whereas, iron content was noted greater in apple followed by papaya. Among the papaya and apple varieties, calcium content was found static. Orange showed little variation in calcium content, however, papaya and apple varieties proved reatively poor source of minerals expressing 0.01 per cent value. As regards the iron content, Red Delicious variety of apple superior to golden Delicious. Iron content ranged from 0.40 per cent (Pusa Giant) to 0.43 per cent in Pusa Delicious and Surya variety of papaya. The present finding in respect of mineral contents are in accordance with the report of (2,3).

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MICROBIOLOGICAL AND PHYSICO-CHEMICAL ANALYSIS OF WASTE WATER OF AJANTA COLONY (MEERUT) FOR IRRIGATION

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Key words: Wastewater, Physico-chemical, Microbiological, Irrigation.

Water is a divine gift. Water is one of the most widely and abundantly used substance in our daily life. Society's rapid evolution has increased the demand for water in every sector. At the same time, the continual production of great quantities of wastewater has led to the view that this should be considered as an alternative water resource. Development of new technologies has extended the possibilities of wastewater reuse (4). The practice of irrigating agricultural crops with municipal wastewater has become more widespread, especially in arid and semiarid areas of both developed and developing countries. The controlled use of untreated and treated wastewater in irrigation and this may now be applied to agriculture at all levels as, to irrigate sports grounds, urban uses, industrial uses, aquifer recharge, etc. is now quite common in Europe, the United States, Mexico, Australia, China, India and the Near East as well as, to a lesser extent, in Chile, Peru, Argentina, the Sudan and South Africa (2). The quality of water therefore assumes considerable importance. Bacteriological and physico-chemical analysis of wastewater determines the water quality and its suitability for irrigation. The aim of the present work was to analyze the wastewater for the same.

MATERIAL AND METHODS

Sample collection: The sample of wastewater was collected from Ajanta colony (Meerut), in sterilized plastic container.

Physico-chemical analysis: Physico-chemical characteristics were done on the same day when sample brought to the laboratory and this was carried out accordingly to standard methods of American Public Health Association (1).

Isolation of Bacteria: Different media *i.e.* Mc Conkey Agar, Xylose Lysine Deoxycholate (XLD) Agar, Mannitol salt Agar, Cetrimide Agar, Columbia Agar and Enterobacteria Enrichment Broth were used for isolation of bacteria. The bacteria were identified based on colonies characteristics, gram staining methods and by various biochemical studies as given by Bergey's Manual of Determinative Bacteriology (3).

RESULTS AND DISCUSSION

Physico-chemical analysis

The physico-chemical analysis of the wastewater showed its slightly basic nature and also the presence of high quantity of both organic as well as inorganic nutrients (Table 1). The value of Dissolved Oxygen (DO) was low which indicate that the highly obnoxious condition. The BOD and COD level of the wastewater were 118 and 280 mg/L. Though BOD and COD level of the wastewater were high as compared to IS Standard, their levels were not so much high. There was no carbonate in the wastewater but fairly high level of free CO_2 (Table 1).

The characteristics of wastewater are shown in Table-1

Table.1. Characteristics of wastewater

S.No.	Parameters	Results
1.	pH	7.9
2.	Color	Pale yellow
3.	Temp	19°C
4.	Turbidity	190 NTU
5.	DO	0.6 mg/l
6.	BOD	118 mg/l
7.	COD	280 mg/l
8.	TS	840 mg/l
9.	TSS	240 mg/l
10.	TDS	700 mg/l
11.	Alkalinity	300 mg/l
12.	Acidity	50 mg/l
13.	Free CO_2	19.8 mg/l

Table 2 Microbial population of wastewater

S. No	Bacteria	Media	Amount of inoculation	Inoculation period (Hours)	Temp.	Observation	Result
1.	*E.coli*	Mc Conkey Agar	0.1 ml	72	30-35°C	Brick red colonies	+ve
		Indole test	0.1 ml	24	43-44°C	Red ring at the interface of medium	+ve
2.	*Salmonella* sp.	XLD Agar	Streaking	18-24	36-38°C	Red with or without black centers	+ve
		Urea Broth	Culture	18-24	36-38°C	Absence of red colour	+ve
3.	*Staphylococcus aureus*	Mannitol salt Agar	Streaking	24	37°C	Yellow colonies with yellow zone	+ve
		Coagulase test	Culture	24	37°C	Coagulation appears	+ve
4.	*Pseudomonas aeruginosa*	Cetrimide Agar	Streaking	24	37°C	Greenish colonies	+ve
		Oxidase test	Spreading	24	37°C	Violet colour appears	+ve
5.	*Clostridium* sp.	Columbia Agar	Streaking	48	30-35°C	Yellow colonies	+ve
		Catalase test	Spreading	-	-	No Formation of gas bubbles	+ve
6.	*Enterobacteria*	Enterobacteria enrichment medium	Streaking	48	30-35°C	Pink colonies	+ve
		Voges-Proskauer test	Culture	24	35°C	Development of pink to red colour within 5 min.	+ve

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